~~Mr. McDuffie~~
Screw-worm

April 1, 1966

Dr. Claude L. Welch, Director
National Cotton Council
P. O. Box 12285
Memphis, Tennessee 38112

Dear Dr. Welch:

You have been informed, I believe, that I contacted Dr. T. B. Davich several months ago concerning the possibility of using the large cage at Iguala, Guerrero, for screw-worm research at times when it was not being otherwise used. Because of the eradication program currently under way in the United States and northern Mexico, it is necessary for us to carry out much of our screw-worm research south of the eradication area and under conditions which would obviate any nuisance to livestock producers. Although we are not sure of the suitability of the climate at Iguala for screw-worm studies, it appears that the large cage recently constructed there might greatly facilitate our research.

Screw-worm eradication activities in Mexico are jointly carried out by the Secretaria de Agricultura y Ganaderia and U. S. Department of Agriculture. As the enclosed copies of correspondence indicate, Dr. Robert S. Sharman of the U. S. Department of Agriculture in Mexico City has contacted his counterpart in the Secretaria and Dr. Gabriel Fernandez de Castro has requested the cooperation of other agencies of the Secretaria. In this way, a formal record of the proposal has been established and we are now in a position to proceed with the research with the knowledge that appropriate officials in Mexico concur with its conduct.

We are hopeful that availability of the cage will facilitate our research on procedures for carrying out screw-worm eradication in Mexico. Any assistance you can give us will be very much appreciated.

Sincerely yours,

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosures 3

cc: W. C. McDuffie
T. B. Davich
S. E. Jones

Screw-worm

April 1, 1956

Dr. Claude L. Welch, Director
National Cotton Council
P. O. Box 12285
Memphis, Tennessee 38112

Dear Dr. Welch:

You have been informed, I believe, that I contacted Mr. T. E. Bevlah several months ago concerning the possibility of using the large cage at Iguala, Guerrero, for screw-worm research at times when it was not being otherwise used. Because of the eradication program currently under way in the United States and northern Mexico, it is necessary for us to carry out much of our screw-worm research south of the eradication area and under conditions which would obviate any nuisance to livestock producers. Although we are not sure of the suitability of the climate at Iguala for screw-worm studies, it appears that the large cage recently constructed there might greatly facilitate our research.

Screw-worm eradication activities in Mexico are jointly carried out by the Secretaría de Agricultura y Ganadería and U. S. Department of Agriculture. As the enclosed copies of correspondence indicate, Dr. Robert E. Sherman of the U. S. Department of Agriculture in Mexico City has contacted his counterpart in the Secretaría and Dr. Gabriel Fernández de Castro has requested the cooperation of other agencies of the Secretaría. In this way, a formal record of the proposal has been established and we are now in a position to proceed with the research with the knowledge that appropriate officials in Mexico concur with its conduct.

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Sincerely yours,

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosures 3

cc: W. C. Mosvitie
T. E. Bevlah
R. E. Jones

RECEIVED

APR 10 1966

Screw-worm

National Cotton Council of America

BOX 12285, MEMPHIS, TENNESSEE 38112

DIVISION OF
PRODUCTION AND MARKETING
RESEARCH — EDUCATION

April 8, 1966

Dr. O. H. Graham, Leader
Livestock Insects Investigations
Entomology Research Division, ARS, USDA
P. O. Box 232
Kerrville, Texas 78028

Dear Dr. Graham:

Reference is made to your letter dated April 1. We are pleased that the cage at Iguala may be more fully utilized in research than was originally contemplated.

Of course, we would urge that nothing be done that would be detrimental to the research in cotton breeding or the research on the boll weevil. This would include the soils, the cage and theplants as well as relationships with the Campo and the Instituto Nacional de Investigaciones Agricolas.

Mr. L. R. Lytton is the agent in charge of U. S. cotton work at Iguala. I am sending him a copy of this letter. I believe you will want some of your people to consult with him before he leaves there about June 1. I am sure you already have these considerations in mind.

If we can be of further assistance please let us know.

Sincerely yours,

C. L. W.

Claude L. Welch
Director

CLW:fc
cc: L. R. Lytton
T. B. Davich
S. E. Jones

Copies sent To
W C McDuffie
B M Waddle
4/11/66

National Cotton Council of America BOX 12285 MEMPHIS TENNESSEE 38112

NATIONAL COTTON COUNCIL OF AMERICA

PRODUCTION AND MARKETING
Washington Office

April 8, 1966

Dr. O. H. Graham, Leader
Livestock Insects Investigations
Entomology Research Division, ARS, USDA
P. O. Box 232
Kerrville, Texas 78028

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If we can be of further assistance please let us know.

Sincerely yours,

Claude L. Welch
Director

CLW:fc
cc: L. R. Lytton
T. B. Davich
S. E. Jones

U.S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

DATE Apr. 21, 1966

TO

Dr. W. C. McDuffie

Entomology Research Division

- [ ] ACTION
- [ ] NOTE AND RETURN
- [ ] APPROVAL
- [ ] PER PHONE CALL
- [ ] AS REQUESTED
- [ ] RECOMMENDATION
- [ ] FOR COMMENT
- [ ] REPLY FOR SIGNATURE OF
- [ ] FOR INFORMATION
- [ ] RETURNED
- [ ] INITIALS
- [ ] SEE ME
- [ ] NOTE AND FILE
- [ ] YOUR SIGNATURE

Insect Man ... Acting

APR 22 1966

W.C.M.
D.L.W.
J.A.

REMARKS Mr. Welch requested that we forward the attached copy of Dr. Waddle's letter of April 12, 1966.

FROM J. B. Pate, Acting Chief

Cotton and Cordage Fibers Res. Br.

Betty – can you make copy of this? want to send to Graham

Strawberry

Copy to O.H. Graham 4-25-66

Cotton and Cordage Fibers
Research Branch

April 12, 1966

AIR MAIL

Mr. Claude L. Welch
National Cotton Council
Post Office Box 12285
Memphis, Tennessee 38112

Dear Claude:

I appreciate your furnishing the correspondence file from Dr. Graham of Entomology Research Division, requesting to use the boll weevil cage at Iguala. Certainly I can see no objection to this plan provided: (1) that there is absolutely no danger of upsetting the present projects on the Campo, and (2) that every effort be made through Lon to be sure that public relations are maintained with the Mexican Ministry of Agriculture officials. I have made these points several times with Sloan Jones and Dial Martin on this and in discussing it yesterday with Sloan, suggested that he may want to emphasize these two points with Dr. McDuffie, Chief, Insects Affecting Man and Animals Research Branch. Sloan thoroughly understands the necessity of having all of the proposed work clear through Lon for these purposes.

I appreciate your keeping me advised on the matter and will follow their plans with keen interest to try to see that nothing upsets our present progress.

Sincerely yours,

Billy M. Waddle

Billy M. Waddle
Chief of Branch

BMWaddle:hlw

Mr. McDuffie
Screw-worm

File

April 13, 1966

Dr. Claude L. Welch, Director
Division of Production and Marketing
National Cotton Council of America
P. O. Box 12285
Memphis, Tennessee 38112

Dear Dr. Welch:

Thank you very much for your letter of April 8. All of us associated with the screw-worm eradication program appreciate very much your willingness to cooperate by making the large cage at Iguala available for our tests.

If it is satisfactory with you, we will coordinate the details of our work by discussing them with Dr. T. B. Davich in advance. Since Dr. Davich is well informed concerning our program, he should be able to judge whether or not anything which we propose would damage the cage, the soil in the cage, or the cooperative relationship with the Instituto Nacional de Investigaciones Agricolas. We will consult with Dr. Davich before going to Iguala and will not undertake any tests of which he does not approve. We will also, of course, check with Mr. Lytton on a day-to-day basis after our people arrive in Iguala.

Thank you again for your help and cooperation.

Sincerely yours,

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
R. S. Sharman
T. B. Davich
S. E. Jones
B. G. Hightower

April 13, 1966

Dr. Claude L. Welch, Director
Division of Production and Marketing
National Cotton Council of America
P. O. Box 12285
Memphis, Tennessee 38112

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Thank you again for your help and cooperation.

Sincerely yours,

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. Mothelle
R. S. Sharman
T. B. Davich
E. H. Jones
B. G. Hightower

Screw-worm

National Cotton Council of America BOX 12285, MEMPHIS, TENNESSEE 38112

DIVISION OF
PRODUCTION AND MARKETING
RESEARCH — EDUCATION

April 15, 1966

Dr. O. H. Graham, Leader
Livestock Insects Investigations
Entomology Research Division
Agricultural Research Service, U.S.D.A.
P. O. Box 232
Kerrville, Texas 78028

Dear Dr. Graham:

This is in reply to your letter dated April 13.

It is entirely satisfactory with us for you to discuss plans for your work at Iguala with Dr. Davich. This should be mutually helpful. Since Mr. Lytton is in charge of our lease and other arrangements at Iguala and Mexico City, I must urge that plans for your work at that Station also be discussed and cleared with him.

We hope you have success in your research at Iguala.

Sincerely yours,

Claude L. Welch
Director

CLW:fc
cc: L. R. Lytton
B. M. Waddle
T. B. Davich
S. E. Jones
W. C. McDuffie ✓

National Cotton Council of America BOX 12285, MEMPHIS, TENNESSEE 38112

DIVISION OF
PRODUCTION AND MARKETING
RESEARCH — EDUCATION

April 15, 1966

Dr. O. H. Graham, Leader
Livestock Insects Investigations
Entomology Research Division
Agricultural Research Service, U.S.D.A.
P. O. Box 232
Kerrville, Texas 78028

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Sincerely yours,

Claude L. Welch
Director

CLW:fc
cc: L. R. Lytton
B. M. Waddle
T. B. Davich
S. E. Jones
W. C. McDuffie

U.S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

DATE April 2

TO

Mr. W.C. McDuffie

- [ ] ACTION
- [ ] NOTE AND RETURN
- [ ] APPROVAL
- [ ] PER PHONE CALL
- [ ] AS REQUESTED
- [ ] RECOMMENDATION
- [ ] FOR COMMENT
- [ ] REPLY FOR SIGNATURE OF
- [ ] FOR INFORMATION
- [ ] RETURNED
- [ ] INITIALS
- [ ] SEE ME
- [ ] NOTE AND FILE
- [ ] YOUR SIGNATURE

REMARKS It will be appreciated if you will review attchd. draft of a letter to Mr. Lytton & suggest any changes you feel are needed. Also, please furnish us Mr. Lytton's mailing address as we do not have it here.

FROM OHS

Point out
cage will be used
only when it is
not in use by
others

Screw-worm

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ENTOMOLOGY RESEARCH DIVISION
P. O. Box 232
KERRVILLE, TEXAS 78028

DRAFT

Mr. L. R. Lytton

Dear Mr. Lytton:

In his letter of April 15 to me, a copy of which was forwarded to you, Dr. Claude L. Welch asked that I furnish you additional details concerning our proposed plans for conducting tests with screw-worm flies in the large cage at Iguala, Guerrero.

About a year ago Dr. T. B. Davich indicated to me that firm plans had been made for the construction of a large cage at Iguala and that this cage would probably be unused about half of each year. Since it appeared that our group would need to conduct tests with screw-worm flies in a large cage in Mexico south of the sterile-fly release zone, Dr. Davich and I felt that increased use of expensive research facilities would be obtained if the screw-worm tests were conducted in the cotton insect cage. I do not know at this time whether or not screw-worm studies can be carried out successfully at Iguala. Only after preliminary experiments have been completed will we know whether or not the climate of Iguala, the location and design of the cage, and other

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ENTOMOLOGY RESEARCH DIVISION
P. O. Box 232
KERRVILLE, TEXAS 78028

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factors which affect the behavior of screw-worm flies will be suitable for our research.

It may also be of interest to you to know that we are in the process of completing a formal cooperative agreement with the Instituto Nacional de Investigaciones Agricolas to cover cooperative research on attractants for screw-worm flies at several locations in Mexico, including Iguala. The joint proposal prepared by Dr. Alejandro Ortega and me has been approved by Dr. Nicolas Sanchez Duron and U.S.D.A. officials in Beltsville, and it is anticipated that the formal agreement will be completed in the near future.

If preliminary studies indicate the feasibility of conducting such research at Iguala, we would like to carry out a series of tests with chemosterilants and attractants for screw-worms in the cage. As we visualize them at this time, these tests would be progressive and sequential in nature, with each step subject to modification in accordance with the results obtained up to that time. In the early phases of the test, we would require only one of the 40- X 80-ft units. As we visualize the studies, they would proceed more or less as follows:

1) Release irradiated adult screw-worm flies in the unmodified cage and study their survival and behavior.

2) Study the effect of such modifiers as daily sprinkling of the cage with water, the placement of potted shrubs, bushes, and other

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vegetation in the cages, the introduction of uninfested and screw-worm-infested animals into the cage.

3) Compare behavior of normal (nonirradiated) ~~Florida and Mexican~~ strain of screw-worm flies in the modified cage, especially their response to food, water, and oviposition stimulants, survival, mating behavior, and so forth.

4) Induction of sterility in normal flies by contact with a chemosterilant under cage conditions.

5) Competitive mating tests between normal and chemosterilized flies under simulated outdoors conditions.

Until we know more about the responses of the flies in the cage, it is difficult to say exactly how attractant tests would be conducted. However, it is possible that at a later date this year or next year it would become desirable to use a second of the 40- X 80-ft units for attractant tests. Our entomologists doing research on attractants and Dr. Ortega and his associates of the Instituto may in the meantime find other locations better suited for the attractant research. It is also possible that anything they want to do with attractants could be carried out in the same unit used for chemosterilant tests.

Dr. Davich has emphasized and we, of course, are aware of the importance of protecting the sides of the cages and the soil from any damage by animals. We propose to place only one or two small calves inside the

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cage at any one time, and these animals would be confined in a temporary stall well separated from the sides of the cage. It would also be feasible to floor this stall with planks or take other precautions to protect the soil from compacting or other damage. If animals were held in the cage for a prolonged period of time, it would be both desirable and feasible to move this stall from spot to spot within the cage.

Both Dr. Welch and Dr. Davich have been most kind, and we deeply appreciate their willingness to make the cage available to us. I can assure that we will take every precaution to protect both the cage and the established cooperative relationships. We are hopeful that availability of the cage will greatly facilitate our research and the eventual eradication of screw-worms from the United States and Mexico.

Dr. Davich mentioned several weeks ago that the cage would probably be available about May 1. We would appreciate any further information you can provide us, as our entomologists would like to start tests in advance of the maximum summer temperatures if at all possible.

Sincerely yours,

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
C. L. Welch
T. B. Davich
S. E. Jones
R. S. Sharman
B. M. Waddle
B. G. Hightower

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O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
C. L. Welch
T. B. Davich
S. E. Jones
R. S. Sharman
B. M. Waddle
D. G. Hightower

Mr. McDuffie
Screwworm

U. S. DEPARTMENT OF AGRICULTURE
ARS ENTOMOLOGY RESEARCH DIVISION
LIVESTOCK INSECTS INVESTIGATIONS
BOX 232, KERRVILLE, TEXAS 78028

April 28, 1966

Mr. L. R. Lytton
Apartado Postal 41
Taxco, Guerrero
Mexico

Dear Mr. Lytton:

In his letter of April 15 to me, a copy of which was forwarded to you, Dr. Claude L. Welch asked that I furnish you additional details concerning our proposed plans for conducting tests with screw-worm flies in the large cage at Iguala, Guerrero.

About a year ago Dr. T. B. Davich indicated to me that firm plans had been made for the construction of a large cage at Iguala and that this cage would probably be unused about half of each year. Since it appeared that our group would need to conduct tests with screw-worm flies in a large cage in Mexico south of the sterile-fly release zone, Dr. Davich and I felt that increased use of expensive research facilities would be obtained if the screw-worm tests were conducted in the cotton insect cage.

It may be of interest to you to know that in the meantime my organization has initiated a formal cooperative agreement with the Instituto Nacional de Investigaciones Agricolas to cover cooperative research on attractants for screw-worm flies at several locations in Mexico, including Iguala. The joint proposal prepared by Dr. Alejandro Ortega and me has been approved by Dr. Nicolas Sanchez Duron and U.S.D.A. officials in Beltsville, and it is anticipated that the formal agreement will be completed in the near future.

I do not know at this time whether or not screw-worm studies can be carried out successfully at Iguala. Only after preliminary experiments have been completed will we know whether or not the climate of Iguala, the location and design of the cage, and other factors which affect the behavior of screw-worm flies are favorable for our research. If the

screw-worm

U. S. DEPARTMENT OF AGRICULTURE
ARS ENTOMOLOGY RESEARCH DIVISION
LIVESTOCK INSECTS INVESTIGATIONS
BOX 232, KERRVILLE, TEXAS 78028

Insects Affecting
Man & Animals

MAY 31 1966

W.C.M.
D.E.W.
J.A.F.

April 22, 1966

Dr. L. R. Ayala
Apartado Postal 41
Tuxtla, Gutierrez
Mexico

Dear Dr. Ayala:

In his letter of April 15 to me, a copy of which was forwarded to you, Dr. Claude L. Welch asked that I furnish you additional details concerning our proposed plans for conducting tests with screw-worm flies in the large cage at Iguala, Guerrero.

About a year ago Dr. T. B. Welch indicated to me that five plans had been made for the construction of a large cage at Iguala and that this cage would probably be needed about half of each year. Since it appeared that our group would need to conduct tests with screw-worm flies in a large cage in Mexico much of the sterile-fly release area, Dr. Welch and I felt that increased use of expensive research facilities would be obtained if the screw-worm tests were conducted in the cotton insect cage.

It may be of interest to you to know that in the meantime my organization has initiated a formal cooperative agreement with the Instituto Nacional de Investigaciones Agrícolas to carry cooperative research on attractants for screw-worm flies at several locations in Mexico, including Iguala. The joint proposal prepared by Dr. Alejandro Ortega and me has been approved by Dr. Nicolas Sanchez Durán and U.S.D.A. officials in Kerrville, and it is anticipated that the formal agreement will be completed in the near future.

I do not know at this time whether or not screw-worm studies can be carried out successfully at Iguala. Only after preliminary experiments have been completed will we know whether or not the climate of Iguala, the location and design of the cage, and other factors which affect the behavior of screw-worm flies are favorable for our research. If the

preliminary studies are encouraging, we would like to carry out a series of tests with chemosterilants and attractants for screw-worms in the cage. As we visualize them at this time, these tests would be progressive and sequential in nature, with each step subject to modification in accordance with the results obtained up to that time. In the early phases of the test, we would require only one of the 40- X 80-ft units. As we visualize the studies, they would proceed more or less as follows:

1) Release irradiated adult screw-worm flies in the unmodified cage and study their survival and behavior.

2) Study the effect of such modifiers as daily sprinkling of the cage with water, the placement of potted shrubs, bushes, and other vegetation in the cages, and the introduction of uninfested and screw-worm-infested animals into the cage.

3) Compare the behavior of various strains of non-irradiated screw-worm flies in the modified cage, especially their response to food, water, and oviposition stimulants, their survival, mating behavior, and so forth.

4) Induction of sterility in normal flies by contact with a chemosterilant under cage conditions.

5) Competitive mating tests between normal and chemosterilized flies under simulated outdoor conditions.

Until we know more about the responses of the flies in the cage, it is difficult to say exactly how attractant tests would be conducted. However, it is possible that at a later date this year or next year it would become desirable to use a second of the 40- X 80-ft units for attractant tests. Our entomologists doing research on attractants, and Dr. Ortega and his associates of the Institute, may in the meantime find other locations better suited for the attractant research. It is also possible that anything they want to do with attractants could be carried out in the same unit used for chemosterilant tests.

Dr. Davich has emphasized and we, of course, are aware of the importance of protecting the sides of the cages and the soil from any damage by animals. We propose to place only one or two small calves inside the cage at any one time, and these animals would be confined in a temporary stall well separated from the sides of the cage. It would be feasible to floor this stall with planks or take other precautions to protect the soil from compacting or other damage. If animals were held in the cage for a prolonged period of time, it would be both desirable and

preliminary studies are encouraging, we would like to carry out a series of tests with transectualists and aerosonts for cross-cross in the cage. As we visualize them at this time, these tests would be progressive and sequential in nature, with each step subject to modifications in accordance with the results obtained up to that time. In the early phases of the tests, we would require only one of the 40- X 20-ft units. As we visualize the system, they would proceed more or less as follows:

1) Balance irradiated adult cross-cross flies in the unmodified cage and study their survival and behavior.

2) Study the effect of such variables as daily ventilation of the cage with water, the placement of potted shrubs, bushes, and other vegetation in the cage, and the introduction of unirradiated and cross-cross-injected males into the cage.

3) Compare the behavior of various strains of non-irradiated cross-cross flies in the modified cage, especially their response to food, water, and oviposition substrate, their survival, mating behavior, and so forth.

4) Induction of sterility in normal flies by contact with a characteristical under cage conditions.

5) Competitive mating tests between normal and characteristical flies under simulated outdoor conditions.

Until we know more about the susceptibility of the flies in the cage, it is difficult to say exactly how extensive tests would be undertaken. However, it is possible that at a later date this year or next year it would become desirable to use a second of the 40- X 20-ft units for additional tests. Our cooperating being research on attractants, and the, strong and key manufacture of the Insecticide, may in the meantime find other facilities better suited for the attractant research. It is also possible that equipment they want to do with attractants could be carried out in the same unit used for characteristical tests.

Mr. Smith has suggested and we, of course, are aware of the importance of protecting the sides of the cages and the wall from any damage by animals. We propose to place only one or two small jalousie inside the cage at any one time, and these jalousie would be carried in a temporary stall well separated from the sides of the cage. It would be feasible to floor this stall with plywood or some other preventative to protect the soil from trampling or other damage. If animals were held in the cage for a prolonged period of time, it would be both desirable and

feasible to move this stall from spot to spot within the cage. All of our tests could be arranged so that we would not use the cage at the time any other group needed it.

Both Dr. Welch and Dr. Davich have been most kind, and we deeply appreciate their willingness to make the cage available to us. I can assure you that we will take every precaution to protect both the cage and the established cooperative relationships. We are hopeful that availability of the cage will greatly facilitate our research and the eventual eradication of screw-worms from the United States and Mexico.

Dr. Davich mentioned several weeks ago that the cage would probably be available about May 1. We would appreciate any further information you can provide us, as our entomologists would like to start tests in advance of the maximum summer temperatures if at all possible.

Sincerely yours,

O. H. Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
C. L. Welch
F. J. Mulhern
R. S. Sherman
E. F. Knipling
H. Sanchez S.
A. Ortega C.
S. E. Jones
T. B. Davich
W. C. McDuffie
B. M. Waddle
B. C. Hightower

Sincerely yours,

G. H. Graham
Investigations Leader
Livestock Insects Investigations

ner
E. L. Smith
F. L. Thomas
E. E. Sherman
E. F. Knipling
H. Gordon R.
A. Dwight G.
I. E. Jones
T. B. Smith
V. C. Chamberlin
E. H. Hadlin
E. G. Titchener

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
CROPS RESEARCH DIVISION

Taxco, Gro., Mexico,
Apartado Postal 41,

May 5, 1966.

Mr. O.H. Graham,
U.S. Department of Agriculture, ARS,
Entomology Research Division,
P.O. Box 232,
Kerrville, Texas, 78028

Dear Mr. Graham:

The cages at Iguala are vacant now and as soon as your plans for work t this summer have been approved by Drs. Sanches and Ortega the work can get underway.

We usually have our maximum tempertures in April and as soon as the rains start it is much cooler in Iguala. We have had two rather good rains and the maximum temperture is running in the high 90s. This doesn't mean that the rains will continue as we usually get these early rains and then a short dry period until the rains really get underway about the middle if June. After the rains start you will not have any trouble maintaining high humidity in the cages. More than likely you will have to worry about getting to the cages without getting stuck in the mud.

Will you please let me know when your men expect to be down. We are in the process of finishing our season's work and I may be away from Iguala part of the time. But I do want to be here when they arrive.

Sincerely,

L.R. Lytton, Agent.
Apartado Postal 41,
Taxco, Gro., Mexico.

Tel. Taxco No. 94.

cc: Mr. Welch
Dr. Waddle
Dr. Davich
Dr. Sanches

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
CROPS RESEARCH DIVISION

Taxco, Gro., Mexico,
Apartado Postal 41,

May 5, 1966.

Mr. O.H. Graham,
U.S. Department of Agriculture, ARS,
Entomology Research Division,
P.O. Box 292,
Harlingen, Texas, 78550

Dear Mr. Graham:

The cages at Iguala are vacant now and as soon as your plans for work this summer have been approved by Drs. Sanchez and Ortega the work can get underway.

As usually have our maximum temperatures in April and as soon as the rains start it is much cooler in Iguala. We have had two rather good rains and the maximum temperature is running in the high 90s. This doesn't mean that the rains will continue as we usually get these early rains and then a short dry period until the rains really get underway about the middle of June. After the rains start you will not have any trouble maintaining high humidity in the cages. More than likely you will have to worry about getting to the cages without getting stuck in the mud.

Will you please let me know when your men expect to be down. We are in the process of finishing our season's work and I may be away from Iguala part of the time. But I do want to be here when they arrive.

Sincerely,

W.A. Lytton, Agent.
Apartado Postal 41,
Taxco, Gro., Mexico.

Tel. Taxco No. 94.

cc: Mr. Welch
Dr. Waddle
Dr. Davich
Dr. Sanchez

Mr. McDuffie
Screw-worm

MAY 13 1966

To : G. W. Irving, Jr., Administrator, ARS

From : E. F. Knipling, Director
Entomology Research Division

Subject: Foreign travel covered by cooperative agreement

We presently have a cooperative agreement pending final approval between this Division and the Instituto Nacional De Investigaciones Agricolas Secretaria De Agricultura Y Ganaderia Estados Unidos Mexicanos. This agreement, if approved, will cover studies on the physiology, behavior, and ecology of the screw-worm fly in Mexico. In order to have these studies carried out, it will be necessary for the cooperator to incur travel expenses approximating $1,500. The total amount of this agreement is $15,000.

We have been advised by the Administrative Services Division that foreign travel under cooperative agreements must have prior approval before travel costs can be incurred. Since all the work under this agreement will be conducted in the Republic of Mexico, it is necessary that the cooperator be permitted to incur travel costs for his employees to travel to the work site and to field locations where infestations occur. Without authorization to expend a portion of the funds under this cooperative agreement for travel, it would be impossible to carry out the program.

If you approve of the expenditure of $1,500 in the Republic of Mexico under this cooperative agreement, please sign and return a copy of this memorandum. A copy of this approval will become a part of the finally executed agreement.

E. F. Knipling

Concurred In:

/s/ George W. Irving, Jr.

May 16, 1966
(Date)

cc:
W. C. McDuffie
O. H. Graham
H. C. Bauer
C/A File

Screw-worm

MAY 13 1966

To : G. W. Irving, Jr., Administrator, ARS

From : E. F. Knipling, Director
Entomology Research Division

Subject: Foreign travel covered by cooperative agreement

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E. F. Knipling

Concurred in:

/s/ Kenneth W. Lang

May 13, 1966
(Date)

cc:
W. C. McDuffie
O. H. Graham
H. C. Bauer
C/A File

Mr. Hightower

May 17, 1966

Mr. L. R. Lytton, Agent
Crops Research Division
ARS - USDA
Apartado Postal 41
Taxco, Gro., Mexico

Dear Mr. Lytton:

Thank you for your very kind letter of May 5. It is encouraging to know that we can hope for moderate temperatures and high humidities at Iguala during the summer months.

After receiving your letter I talked to Dr. Alejandro Ortega by telephone; he and Dr. Sanchez Duron had seen copies of our correspondence. Dr. Ortega told me that our proposed tests have their approval and that he would write me to this effect with a copy to you.

As mentioned in our telephone conversation today, Dr. B. G. Hightower and Dr. N. H. Crystal of our Screw-Worm Research Laboratory at Mission, Texas, plan to fly to Mexico City on May 22 and will contact you on the 23rd. Dr. Hightower told me that it probably will not be feasible for them to arrive in Iguala before noon on the 23rd; therefore, they will plan on going directly to Taxco and contacting you in Taxco during the afternoon of May 23. If for any reason there is a delay or change of any kind, Dr. Hightower will contact you directly; he has your telephone number and mailing address.

Drs. Hightower and Crystal plan to release some irradiated screw-worm flies in the cage during the week of the 23rd and observe their behavior. On the basis of this preliminary test, they can propose other tests and consult with you about the best times for conducting them.

May 17, 1966

Mr. L. M. Lyster, Agent
Crops Research Division
ARS - USDA
Quarantine Postal 51
Tampa, Fla., Mexico

Dear Mr. Lyster:

Thank you for your very kind letter of May 5. It is encouraging to know that we can hope for moderate temperatures and high humidities at Iguala during the summer months.

After receiving your letter I talked to Dr. Alejandro Ortega by telephone; he and Dr. Briones Tacon had been copies of our correspondence. Dr. Ortega told me that our proposed tests have their approval and that he would write me in this effect with a copy to you.

As mentioned in our telephone conversation today, Dr. E. Eighmeier and Dr. M. M. Crystal of our Brown-Cork Research Laboratory at Mineola, Texas, plan to fly to Mexico City on May 22 and will contact you on the 23rd. Mr. Eighmeier said to that it probably will not be feasible for them to arrive in Iguala before noon on the 23rd; however, they will plan on going directly to Tacon and contacting you in Tacon during the afternoon of May 23. If for any reason there is a delay or change of any kind, Mr. Eighmeier will contact you directly by his your telephone number and mailing address.

Mr. Eighmeier and Crystal plan to release some irradiated screwworm flies in the cage during the week of the 23rd and observe their behavior. On the basis of this preliminary test, they can propose other tests and consult with you about the best times for conducting them.

We appreciate your willingness to cooperate with us in the conduct of this research.

Sincerely yours,

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
C. L. Welch
F. J. Mulhern
R. S. Sharman
E. F. Knipling
H. Sanchez D.
A. Ortega C.
S. E. Jones
T. B. Davich
W. C. McDuffie
B. H. Waddle
B. G. Hightower

MAY 26 1966

SECRETARIA DE AGRICULTURA Y GANADERIA

INSTITUTO NACIONAL DE INVESTIGACIONES AGRICOLAS

LONDRES NO. 40
MEXICO 6, D. F.

TELS. 11-00-00
11-00-10
11-00-01

May 20, 1966.

Dr. O.H. Graham
Post Office Box 232
Kerville, Texas 78029
U.S.A.

Dear Dr. Graham:

Through the copy of your letter of April 28, to Mr. Lytton, we have learn about the work that you and your colleagues plan to conduct with screw-worm flies in the large cage at Iguala, Guerrero. We wellcome the opportunity to collaborate in proyects of mutual interest.

From your letter we understand that Dr. Davich has come to an agreement with you, for using the cage to conduct such work. We will endorse the arrangements you agree upon.

We want to indicate that the proposed outline of your studies is entirely satisfactory to us.

Truly yours,

Alejandro Ortega C., Head
Entomology Department

c.c. Dr. Nicolás Sánchez Durón, Director I.N.I.A.
Dr. T.B. Davich, Director Boll weevil Res. Lab.
Mr. L.D. Lytton, Agent.

AOC/ogp

SECRETARIA DE AGRICULTURA Y GANADERIA

INSTITUTO NACIONAL DE INVESTIGACIONES AGRICOLAS

May 20, 1966.

Dr. O.H. Graham
Post Office Box 232
Kerville, Texas 78029
U.S.A.

Dear Dr. Graham:

Through the copy of your letter of April 28, to Mr. Lytton, we have learn about the work that you and your colleagues plan to conduct with screw-worm flies in the large cage at Iguala, Guerrero. We welcome the opportunity to collaborate in projects of mutual interest.

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Alejandro Ortega C., Head
Entomology Department

c.c. Dr. Nicolás Sánchez Durón, Director I.N.I.A.
Dr. T.S. Davlch, Director Boll weevil Res. Lab.
Mr. L.D. Lytton, Agent.

AOC/ogp

xxxxx Division
Mission, Texas

June 2, 1966

To: O. H. Graham
Investigations Leader
Livestock Insects Investigations
Kerrville, Texas

From: R. B. Davis and R. Pratt

Subject: Progress Report.--Field experiments at St. Helena Ranch
Poza Rica, Veracruz, Mexico

Objectives:

Experiment No. 1.--To attempt to rear native screw-worm flies through several life cycles, using wounded sheep confined in a fly-proof cage.

Experiment No. 2.--To attempt to rear screw-worm larvae in a medium of fresh beef meat under conditions that will attract oviposition by native female screw-worm flies.

Materials:

Experiment No. 1.--An 18 foot square, screened cage of 6-8 ft height with a sloping, gabled top was built. The cage was divided into 2 parts by a screen partition so that replicated experiments could be run simultaneously. Double doors through an entrance vestibule to each side of the cage provided extra fly-proofing. Wire pens constructed within each side of the cage provided space for 3 sheep to a side. The bottom perimeter of the cage was sealed by a 12" strip of galvanized tin set 6" into the ground. A 6" layer of clean river sand, placed over the cleaned surface of the ground, provided a friable floor into which the pupating screw-worm larvae could burrow, and permitted drain-off of excess rain water.

Experiment No. 2.--A 5 gallon butane tank was rigged with appropriate valves and regulators to provide fuel for a small open-flame burner. The tank and burner were housed in a compact cylindrical tin cover along with a burner grate and a 3 liter stainless steel water bath. This arrangement permitted the maintenance of fairly constant temperatures, up to 170°F, in the 2 liters of water placed in the water bath. A stainless steel disc was made to fit tightly over the top of the water bath and a 4" diameter stainless steel, fine mesh strainer was welded into a hole cut in the middle of the disc. Fresh meat placed in this strainer was thus suspended over the hot-water bath and could be kept at fairly constant temperature over a range from anywhere from 80°F to 120°F. A six liter, stainless steel drum was rigged in position about 12" above the disc and strainer so that the contents of the drum could be made to drip slowly down into the meat in the strainer. The space from the perimeter of the disc to the bottom of the drum

Insect Division
Mission, Texas

June 2, 1955

To: O. H. Graham
Investigations Leader
Livestock Insects Investigations
Kerrville, Texas

From: R. B. Davis and R. Pratt

Subject: Progress Report.--Field experiments at St. Helena Ranch
Casa Blea, Veracruz, Mexico

Objectives:

Experiment No. 1.--To attempt to rear native screw-worm flies through several life cycles, using wounded sheep confined in a fly-proof cage.

Experiment No. 2.--To attempt to rear screw-worm larvae in a medium of fresh beef meat under conditions that will attract oviposition by native female screw-worm flies.

Materials:

Experiment No. 1.--An 18 foot square, screened cage of 5-6 ft height with a sloping, gabled top was built. The cage was divided into 2 parts by a screen partition so that replicated experiments could be run simultaneously. Double doors through an entrance vestibule to each side of the cage provided extra fly-proofing. Wire pens constructed within each side of the cage provided space for 2 sheep to a side. The bottom perimeter of the cage was sealed by a 12" strip of galvanized tin set 6" into the ground. A 6" layer of clean river sand, placed over the cleaned surface of the ground, provided a friable floor into which the pupating screw-worm larvae could burrow, and resulted drain-off of excess rain water.

Experiment No. 2.--A 5 gallon butane tank was rigged with appropriate valves and regulators to provide fuel for a small open-flame burner. The tank and burner were housed in a compact cylindrical tin cover along with a burner grate and a 3 liter stainless steel water bath. This arrangement permitted the maintenance of fairly constant temperatures, up to 170°F, in the 2 liters of water placed in the water bath. A stainless steel disc was made to fit tightly over the top of the water bath and a 6" diameter stainless steel, fine mesh strainer was welded into a hole cut in the middle of the disc. Fresh meat placed in this strainer was thus suspended over the hot-water bath and could be kept at fairly constant temperature over a range from anywhere from 90°F to 120°F. A six liter, stainless steel drum was rigged in position above 12" above the disc and strainer so that the contents of the drum could be made to drip slowly down into the meat in the strainer. The space from the perimeter of the disc to the bottom of the drum

was encircled by a hardware cloth cylinder to prevent large insects, lizards and rodents from bothering the meat in the strainer. The whole device was so assembled that it could not be easily overturned or shaken apart.

Procedures:

Experiment No. 1.--On March 25, 1965 the cage was completed and 3 sheep, 2 adult ewes and 1 ram, were placed in each of the 2 pens inside the cage. Food and water were provided to them every day and they were thus maintained until April 6. On this date a 1-inch diameter wound was made in the shoulder of each ram, and 16 1st instar screw-worm larvae were introduced into each wound. The larvae grew well and apparently none died in the wounds. They reached 3rd instar in 4 days and none were left in either wound in 6 days, all apparently dropping out to pupate, though none were seen in the act. Ground temperatures throughout this period were between 74° and 80°F; air temperatures were between 76° and 88°F. There were frequent showers, almost daily. After one month no flies had emerged from pupae inside the cage. Liter samples of the sand, taken at each of 4 places in each side of the cage did not contain any pupae or pupae cases.

The experiment was repeated, beginning on May 5, 1966, with infestation of the wounds with 16 1st instar larvae each. The larvae had all left the wounds by May 10. On May 16 five screw-worm flies, 2 males and 3 females, were found in the west cage, none in the east cage. On May 16 there were 5 in the west and 3 in the east - 1 female and 2 males. Honey feeders were maintained in both cages and an open wound was kept on a sheep in each cage from May 16 on. No interest of one fly in another or in the sheep was noted during daily observation periods of 2 hr in midmorning and 2 hr in late afternoon. On May 19 and 20 only 4 flies were found in the west cage, and 1 in the east cage. Three and 1 were found on May 21 and 22. On May 23 none were found on either side. Throughout the 8 days when flies were present, they flew well when disturbed. Some were seen feeding on the honey. Most of their time was spent in resting on the roof of the cages. Brief flights of a random appearing sort were usually made by all flies every 30-60 minutes.

The test was terminated after the flies disappeared, and the cage was dismantled preparatory to moving it to Cotaxtla, Veracruz, as ordered.

Experiment No. 2.--The device for heating a ball of fresh beef meat was set up first on March 15. No larvae were available so it was run for a week with just the meat. Ten gallons of beef blood was obtained from a slaughter house and coagulated with vitamin K, then decanted and preserved with 1 1/2% formaldehyde. Some of this fluid was diluted with an equal volume of water and placed in the drum at the top of the device we called the "artificial wound". The blood mixture would not drip for long without clogging

was encircled by a hardware cloth cylinder to prevent large insects, like ants and roaches from bothering the meat in the structure. The whole device was so assembled that it could not be easily overturned or shaken apart.

Procedures:

Experiment No. 1.--On March 25, 1943 one cage was completed and 5 sheep, 2 adult ewes and 1 ram, were placed in each of the 2 pens inside the cage. Food and water were provided to them every day and they were thus maintained until April 5. On this date a 1-inch circular wound was made in the shoulder of each ram, and 10 let larvae screw-worm larvae were introduced into each wound. The larvae grew well and apparently none died in the wounds. They reached 3rd instar in 4 days and none were left in either wound in 5 days, all apparently dropping out to pupate, though none were seen in the act. Ground temperatures throughout this period were between 70° and 80°F; air temperatures were between 70° and 80°F. There were frequent showers, almost daily. After one month no flies had emerged from pupae inside the cage. Litter samples of the sand, taken at each of 4 places in each side of the cage did not contain any pupae or pupae cases.

The experiment was repeated, beginning on May 3, 1943, with inoculation of the wounds with 10 1st instar larvae each. The larvae had all left the wounds by May 10. On May 16 five screw-worm flies, 2 males and 3 females, were found in the west cage, none in the east cage. On May 16 there were 3 in the west and 1 in the east - 1 female and 2 males. Honey feeders were maintained in both cages and an open wound was kept on a sheep in each cage from May 16 on. No increase of one fly in another or in the sheep was noted during daily observation periods of 2 hr in morning and 2 hr in late afternoon. On May 19 and 20 only 4 flies were found in the west cage, and 1 in the east cage. Three and 1 were found on May 21 and 22. On May 23 none were found on either side. Throughout the 8 days when flies were present, they flew well when disturbed. None were seen feeding on the honey. Most of their time was spent in resting on the roof of the cages. Brief flights of a random appearing sort were usually made by all flies every 30-60 minutes.

The test was terminated after the flies disappeared, and the cage was disinfected preparatory to moving it to Gainesville, Veracruz, as ordered.

Experiment No. 2.--The device for heating a bait of fresh beef meat was set up first on March 19. No larvae were available so it was run for a week with just the meat. Two gallons of beef blood was obtained from a slaughter house and coagulated with vitamin K, then decorted and preserved with 1 1/2% formaldehyde. Some of this fluid was diluted with an equal volume of water and placed in the drum at the top of the device we called the "artificial wound". The blood mixture would not dry for long without clogging

and one night the butane valve malfunctioned, permitting too much gas to flow and causing the vent to overheat and blow out the safety valve. The device was returned to Mission, repaired and rebuilt with a positive regulator on the butane tank, and returned to Poza Rica.

The problem of getting the blood mixture to drip was not solved until the dilution was carried down to 1 part blood to 5 parts water. By this time the blood stock seemed to be toxic, as not even the ubiquitous ants would feed on it when offered to them. The single screw-worm egg mass available for placement in the meat apparently was killed within 3 hr after exposure to the drip.

Fresh blood was then used daily, but no egg masses or larvae, in excess of those needed for the cage study, could be found. The device was run without these for over a month to see what other flies might oviposit on the meat. One batch of live-born larvae, apparently from Lucelia sp. was found on one occasion. The temperature of the water bath was kept at 145-160°F and the meat at 85-105°F throughout this test. The butane tank held enough to run day and night for about 2 weeks. The 6 liter drum of blood fluids had to be refilled every day, but held enough for about 26 hr operation at a rate of a drip per 3 seconds.

Discussion:

The fly cage will be reassembled at Cotaxtla and the efforts to cycle native flies will be resumed, using many more larvae per wound.

The artificial wound will be operated at Cotaxtla using screw-worm larvae as quickly as they can be procured, and efforts will be made to control meat temperatures within a more narrow range, between 80-90°F.

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Fresh blood was then used daily, but no egg masses or larvae, in excess of those needed for the cage study, could be found. The device was run without there for over a month to see what other flies might oviposit on the meat. One batch of live-born larvae, apparently from Lucilia sp. was found on one occasion. The temperature of the water bath was kept at 140-160 F and the meat at 85-100°F throughout this test. The butane tank held enough to run day and night for about 2 weeks. The 6 liter flask of blood fluid had to be refilled every day, but held enough for about 26 hr operation at a rate of a drip per 3 seconds.

Discussion:

The fly cage will be reassembled at Catacita and the efforts to cycle native flies will be resumed, using many more larvae per wound.

The artificial wound will be operated at Catacita using screw-worm larvae as quickly as they can be procured, and efforts will be made to control meat temperatures within a more narrow range, between 80-90°F.

Mr. McDuffie Screw-worm

Entomology Research Division
Kerrville, Texas

Progress Report on tests undertaken at Poza Rica

R. B. Davis
Research Biologist
Livestock Insects Investigations
Mission, Texas

June 3, 1966

Thank you for providing me with the very interesting report on the research on screw-worm biology and behavior conducted by you and Mr. Pratt at Poza Rica. Since it was necessary to close out the work at Poza Rica, I am very glad that you prepared a Progress Report on the observations which were made there. Even though the tests did not yield the definitive data which we would have liked, I feel that they were very worthwhile and will furnish a basis for more complete studies at Cotaxtla.

I had intended to suggest that you include the observations which you have made in the next Quarterly Report, and I feel that with only slight revision your report of June 2 will be suitable for the Quarterly Report.

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
B. G. Hightower

Entomology Research Division
Ferryville, Texas

Progress Report on tests undertaken at Poza Rica

June 3, 1956

R. B. Davis
Research Biologist
Livestock Insects Investigations
Mission, Texas

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O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
R. G. Hightower

Screwworm

AS FORM 114 (12-61)
UNITED STATES GOVERNMENT

Memorandum

U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Entomology Research Division
Kerrville, Texas

SUBJECT: Use of large cage at Iguala, Guerrero

TO: W. C. McDuffie, Chief
Insects Affecting Man and
Animals Research Branch
Beltsville, Maryland

DATE: June 8, 1966

You will remember that in previous correspondence, Mr. L. R. Lytton asked that we obtain formal concurrence of the Instituto Nacional de Investigaciones Agricolas for our proposed research activities at Iguala. Dr. Alejandro Ortega has supplied this concurrence in the form of a letter written to me with a copy to Mr. Lytton. A copy of Dr. Ortega's letter is enclosed for your information and for the record.

O H Graham
O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosure

cc:
C. L. Welch
F. J. Mulhern
R. S. Sharman
E. F. Knipling
S. E. Jones
W. C. McDuffie
B. M. Waddle
B. G. Hightower

Entomology Research Division
Kerrville, Texas

Use of large cage at Iguala, Guerrero

June 8, 1965

W. C. McDuffie, Chief
Insects Affecting Man and
Animals Research Branch
Beltsville, Maryland

You will remember that in previous correspondence, Mr. L. R. Lytton asked that we obtain formal concurrence of the Instituto Nacional de Investigaciones Agrícolas for our proposed research activities at Iguala. Dr. Alejandro Ortega has supplied this concurrence in the form of a letter written to me with a copy to Mr. Lytton. A copy of Dr. Ortega's letter is enclosed for your information and for the record.

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosure

cc:
C. L. Welch
F. J. Mulhern
R. S. Sharman
E. V. Knipling
L. E. Jones
W. C. McDuffie
B. M. Waddle
S. C. Hightower

NAME OF AGENCY

PRECEDENCE

ACTION:

INFO.:

TYPE OF MESSAGE

☐ SINGLE ☐ BOOK

☐ MULTI-ADDRESS

SECURITY CLASSIFICATION

ACCOUNTING CLASSIFICATION

THIS BLOCK FOR USE OF COMMUNICATIONS UNIT

STANDARD FORM 14 REV. MARCH 15, 1957
GSA REGULATION 2-IX-203.04
14-303

TELEGRAPHIC MESSAGE

OFFICIAL BUSINESS
U. S. GOVERNMENT

MESSAGE TO BE TRANSMITTED (Use double spacing and all capital letters)

THIS COL. FOR AGENCY USE

START MESSAGE ADDRESS HERE

Night Letter
June 10, 1966
Mexico City, Mexico

O. N. Graham
ARS, ENT, USDA
Kerrville, Texas

Dr. Ortega informs me papers regarding contract not yet received. Request a tracer. Reply to Dr. Ortega. Needs 3 to 4 days here processing before resubmission by June 31.

Dr. R. B. Davis

2:45 p.m., ~~Mayxxx~~ June 10, Doris
Given to Roger & Vivian.

DO NOT TYPE MESSAGE BEYOND THIS LINE

PAGE NO. | NO. OF PAGES

NAME AND TITLE OF ORIGINATOR (Type)

ORIGINATOR'S TEL. NO.

DATE AND TIME PREPARED

SECURITY CLASSIFICATION

I certify that this message is official business, it not personal, and is in the interest of the Government.

(Signature)

U.S. GOVERNMENT PRINTING OFFICE: 1958 O-511850

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June 10, 1964
Mexico City, Mexico

O. H. Graham
AXD, EXT, WEMA
Harrville, Texas

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Dr. R. B. Davis

2:45 p.m., Mexico June 10, Davis
Given to Roger S Vivian.

Mr. McDuffie
Screwworm

June 13, 1966

Dr. Alejandro Ortega C., Head
Entomology Department
Instituto Nacional de
Investigaciones Agricolas
Londres 40
Mexico 6, D. F.

Dear Alejandro:

Apparently the Cooperative Agreement for signature by Dr. Sanchez Duron was mailed from Beltsville, Maryland, on June 8. My inquiry last week was, therefore, a little bit premature, but I presume that the letter will arrive in Mexico City no later than today.

I appreciate very much the effort which you and Dr. Davis made to keep me informed about this matter.

Sincerely yours,

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
B. G. Hightower
R. B. Davis

June 15, 1956

Dr. Alejandro Ortega G., Head
Entomology Department
Instituto Nacional de
Investigaciones Agrícolas
Londres 40
México 6, D. F.

Dear Alejandro:

Apparently the Cooperative Agreement for signature by Dr. Wenchen Huang was mailed from Beltsville, Maryland, on June 8. My inquiry last week was, therefore, a little bit premature, but I presume that the letter will arrive in Mexico City no later than today.

I appreciate very much the effort which you and Dr. Davis made to keep me informed about this matter.

Sincerely yours,

O. H. Graham
Investigation Leader
Livestock Insects Investigations

cc:
W. C. Mitchell
E. C. Hightower
E. H. Davis

Screwworm

Cages
Iguala
mexico

June 16, 1966

Mr. L. B. Lytton
Apartodo Postal 41
Taxco, Guarrero
Mexico

Dear Mr. Lytton:

I would like to take this opportunity to express our appreciation for your assistance in arranging for the use of large cages at Iguala and in initiating certain phases of our screw-worm fly research under these conditions. This highly important work could not have been undertaken without those cages.

I am sure our people appreciate the importance of not doing anything to damage the cages or to adversely affect the uses for which they were intended. However, if any of their activities seem harmful in your opinion, we hope you will not hesitate to suggest remedial measures.

Thanks again for your kindness and assistance to our people.

Sincerely yours,

W. C. McDuffie

W. C. McDuffie, Chief
Insects Affecting Man and
Animals Research Branch

cc:
O.H.Graham, M&A
B.G.Hightower, M&A
S.E.Jones, Cotton
B.M.Waddle, "
C. Welch, "

WCMcDuffie/mej

Jet

June 16, 1966

Mr. L. E. Lytton
Aparado Postal 41
Tecoc, Guerrero
Mexico

Dear Mr. Lytton:

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Sincerely yours,

W. C. McDuffie, Chief
Insects Affecting Man and
Animals Research Branch

cc:
G.H.Graham, MSA
G.E.Mightower, MSA
J.E.Jones, Cotton
G.H.Waddle, "
E. Welch, "

WCMcDuffie/mej

Mr. McDuffie

gr 7 m-R

xx 986
xxxxxxxxxxxxxxxxxxxx
Mission, Texas 78572

June 7, 1966

Mr. L. B. Lytton
Apartodo Postal 41
Taxco, Guerrero
Mexico

Dear Mr. Lytton:

This is a somewhat tardy reply to your oral request for a brief description of my plans for the next screw-worm fly test at Iguala.

Let me begin by saying that the flies did very well in the cage through Wednesday, the day you left for Mexico City. That night, however, there was a very heavy rainstorm and by the next morning about 95% of the flies had died. I feel that this mortality can be attributed to the mechanical action of the rain, that is, the flies being washed off the screen and perhaps drowning in ground pools.

My next test will be a repetition of the first one with appropriate modifications. First, I plan to suspend more satisfactory honey and water feeding devices from several of the roof cross members. These devices will merely be two pie plates flexibly joined one above the other. Feeders, placed on the lower plate, will be protected by the upper one.

The flies seemed to prefer the wall-roof angles as resting sites. I plan to provide some additional protection for them by loosely tacking some foot-wide transparent plastic along these edges. Finally, I hope to be able to obtain some more potted shrubs to place inside the cage.

I expect to return to Taxco within the next week or two in order to release another group of flies in the Iguala cage with these improved conditions. Many thanks for your kindness and assistance during my first visit.

Sincerely yours,

Maxwell M. Crystal, Ph.D.
Research Entomologist

cc:
O. H. Graham
B. G. Hightower

xx 969
xxxxxxxxxxxxxxxxxx
Mission, Texas 78572

June 7, 1969

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Apartado Postal 41
Jacco, Guerrero
Mexico

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Maxwell R. Crystal, M.D.
Research Entomologist

cc:
O. H. Graham
B. C. Hightower

AD-311 (7-61) U.S. DEPARTMENT OF AGRICULTURE

Mr. McHaffey Screwworm

SPEED-MEMO

6-1-1966

TO: O. H. Graham
Assistant Director

SUBJECT: Termination of tests in the field cage at Iguala

FROM: B. G. Blanchard
Entomologist In Charge

MESSAGE (Write concise message. Sign and forward parts 1 and 2 to addressee. Retain part 3)

There appears to be too many personnel problems involved in the project at Iguala. Dr. Crystal would like to wait until our cage is set up in Cotaxla and shift the project to Veracruz. The cage should be ready in about 30 days, and there will be quite a bit of activity there for the next several months at least.

I have sent a note to Mr. Lytton and expressed our appreciation for his cooperation, but he is on home leave now and probably won't get it until he returns.

If you agree to this change, we should notify Dr. Ortega and Dr. Davich.

SIGNATURE

REPLY (Use this space for reply. Sign and date. Return part 2 to sender. Retain part 1)

I have no objection to postponing further tests at Iguala until Dr. Crystal has an opportunity to conduct some preliminary trials at Cotaxtla. However, I feel that we should leave the arrangement at Iguala open so that we could return to that location in event that it is not possible to carry out the tests at Cotaxtla.

I suggest that you write a letter to Dr. Ortega, with a copy to Dr. Davich and Mr. Lytton, telling them that we would like to suspend test work at Iguala until we have had an opportunity to compare the suitability of Cotaxtla and Iguala for screw-worm research.

Thermo-Fax copy:
W. C. McDuffie

SIGNATURE

DATE June 16, 1966

AD-311 (7-61)

U.S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

DATE 1.6

TO

Dr. Knipling

JUL 6 1966

EFK
CHI
~~PWC~~
JFC
LBR
RRR

- [ ] ACTION
- [x] NOTE AND RETURN
- [ ] APPROVAL
- [ ] PER PHONE CALL
- [ ] AS REQUESTED
- [ ] RECOMMENDATION
- [ ] FOR COMMENT
- [ ] REPLY FOR SIGNATURE OF
- [ ] FOR INFORMATION
- [ ] RETURNED
- [ ] INITIALS
- [ ] SEE ME
- [ ] NOTE AND FILE
- [ ] YOUR SIGNATURE

REMARKS The 6 weeks with Shaumam were spent in the office contrary to our directions to Dr. Shaumam and Dr. Davis. I discussed with Hugh and we agreed Davis should get back to his own work as originally planned on July 1.

FROM

EWC

GPO : 1964 OF—742-059

FORM AD-514 (8-64)

Mr. McGuffie
Screwworm

Entomology Research Division
Kerrville, Texas

Research on screw-worm ecology in Mexico

R. B. Davis, Research Biologist
c/o R. S. Sharman, Co-Director
Comision Mexico-Americana para la
Prevencion de la Fiebre Aftosa
Mexico, D. F.

June 24, 1966

Confirming our telephone conversation of Monday, it is mandatory that you return to Mission in time to arrive there not later than midnight, June 30. Your detail to Dr. Sharman's office will have been completed at that time, and you should resume your research assignment as soon as possible after July 1. As mentioned in our conversation, I will not object if you spend a limited amount of time at Mission completing whatever summaries or reports as are unfinished at that time, but you should pick up your research as quickly as possible after July 1.

No doubt you are aware we have had a number of unfilled vacancies on our professional staff since several of our people transferred to Fargo, yet we urgently need to accelerate the pace of the screw-worm research program. It is for these reasons as well as a probable shortage of travel funds that I insist that you return to our program on schedule.

Incidentally, I was very disappointed to learn that you had not been to the field during the entire time of your detail to Dr. Sharman's office. I strongly feel that you cannot correctly interpret survey data and reports without completing at least a small number of field studies in representative areas of Mexico. There is no substitute for personally conducted field observations and studies, and this is especially true for studies of screw-worm ecology. Therefore, I hope that you will complete as many field observations as possible in the limited time still available.

I felt it was clearly understood in April that you were going to Mexico City, not primarily to summarize and evaluate the survey data collected by ANH Division, but to carry out more detailed studies which would supplement and augment the ANH Division Southern Survey. These "surveys in depth" of a few representative municipios would have, I felt, facilitated the interpretation of the accumulated survey data if carried out be a professional ecologist or an entomologist with ecological training and experience. Perhaps I have misunderstood what you have accomplished in

Entomology Research Division
Kerrville, Texas

Research on screw-worm ecology in Mexico

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the 2-1/2-month period, but I fear you have missed an opportunity to study the causes of screw-worm population fluctuations in central and southern Mexico.

It was my pleasure to approve this week your PD Form 85, Certification for Eligibility for Within-Grade Pay Increase. This reminded me that you will soon have been with our organization for two years. You brought with you an accumulation of training and experience that has already been valuable to us and will, I am sure, be more valuable as you learn more about the one species on which we are concentrating. The only recommendation I have for your future activities which would involve a change is that you make an effort to outline a few clearly defined studies, and concentrate your efforts on these projects until they are complete. These studies should be sufficiently limited in scope to permit their conduct with the funds, facilities, and personnel currently available and to permit their conclusion within a reasonable time frame. In this way you can, I believe, increase your contributions to the screw-worm research program and at the same time advance your career as a research scientist.

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
R. S. Sharman
B. G. Hightower

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G. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie
R. S. Sherman
B. C. Hightower

From Dr. Williams - ANH 7/19/66 Sent to Dr. Mulhe 7/8/66 Screw-worm mexico

File m+a gen.

ERD-USDA Research Currently Being Done Which
Will Benefit Contemplated Programs
(Eradication of Screwworm from Mexico)

Field Studies in South Texas:

Routine fly release over a cattle ranch in Texas is being used to compare the Mexican strain of flies with ANH produced flies as to the trapability and longevity in the field.

Effect of Wound Age:

Studies with sheep in the laboratory are revealing that larvae will grow much faster on an old wound than on a fresh one. Additional studies to elucidate the reason for this are in the planning stage.

Mating Comparison:

The routine tests for survival, the sexual aggressiveness tests, the longevity of adult flies in small cages, and the mating success of adult males are being used to compare the Mexican strain with the ANH plant strain.

Biological Studies:

The Bio-climatic chamber is nearing completion for studies of Mexican and plant strain under simulated day-night temperatures and light to see if these factors are important in rearing either fly or larvae in the laboratory.

Fly Size Studies:

Work is in progress to discover the importance of the size of plant reared sterile flies. This is in cooperation with the ANH Methods Development group.

Sub-100 nanometer lithography using ultra-thin Vinyl Phenol Photoresist layers
(Department of Electrical Engineering)

Field Studies in Upper Texas

Surface fly-ashes with a sandy matrix in Texas is being used to compare the Fenton matrix of fines with AMD produced fines on the crazability and longevity in the field.

Effect of Wind Abr.

Studies with sheep in the laboratory are traversing that larvae will grow much larger on an old wound than on a fresh one. Additional studies to elucidate the reason for this are in the planning stage.

Healing Constraints

The constraints for survival, the normal agricultural tests, the longevity of mats also in small cages, and the mating success of male males are being used to compare the Fenton strain with the AMD plant strain.

Biological Survey

The air-borne microbe observed in growing complaint for growing of Dacton and plant strain under controlled day-night temperature and light to see if these factors are important in causing either fly or larvae in the laboratory.

Fly Size Genetics

Work is in progress to discover the importance of the use of plant resin cereals fibre. This is in cooperation with the AMD matching development group.

USDA-ERD RESEARCH DURING THE LAST TEN YEARS WHICH IS OF DIRECT BENEFIT TO THE SCREWWORM PROGRAM

MASS PRODUCTION TECHNIQUES

In 1956, techniques for the mass production of sterile screwworm flies were worked out at Orlando, Florida. This included the selection of a vigorous strain of Florida flies whose males had the capability of mating 17 times opposed to 5 times for the native male. This strain is still being used in eradication operations.

FILLD TESTS FOR 2,000 SQUARE MILES EAST OF ORLANDO, FLORIDA

Release was begun May 1, 1957 and by July, 70% of the egg masses collected from infested animals were sterile. This field test proved the feasibility of carrying out the large scale screwworm eradication program in the Southeastern United States. During 1956-1957, much of the fly production equipment which was later used in the eradication program was designed and perfected.

ECOLOGY

In 1962, tests were conducted with sterile flies marked with a flourescent dye and it was found that these flies tended to rest along water courses. Other field tests proved that the flies preferred habitats along streams. This resulted in the development of the strategic method of releasing sterile flies along water courses and with continuance of the grid system of release over the eradication areas as a whole to assure that sterilized flies would also be put out wherever native screwworms might be living in less obvious environments.

In the summer of 1963, ERD workers in cooperation with the AMH Division Methods Development Group at Mission, used dyed flies to demonstrate that flies could migrate at least 180 miles along water courses in approximately 10 days. This data was the basis for making the barrier zone much wider than was originally planned.

The original concept of a barrier included an area 50 miles wide. After it was determined that screwworm flies could fly 180 miles, the principal screwworm fly habitats in Northern Mexico were surveyed. This work was done in 1963-1964. As a result of these studies and the use of the strategic method of fly release, it was possible to maintain a more effective barrier over all of Northern Mexico without substantially increasing the production of flies.

RADIATION BIOLOGY

Research work carried out in Kerrville and Mission, Texas, from 1961-1963 demonstrated that pupae should be irradiated at a more mature stage in their development than was used during the Florida program. The dose was further refined and radiation dosage was standardized at between 6-10,000 Roentgens which represented a decrease in the radiation dose used during the Florida program. This resulted in complete sterility with less deleterious effect to the insect.

ERD-USDA Research Being Done Now Which Will Benefit Present Screwworm Eradication Program

Selection of Improved Strains:

In a program which is based on the rearing and sterilization of so many billions of screwworm flies, it is extremely important that a vigorous, active strain of flies be selected and maintained as a source of eggs for the mass rearing of sterile males. Laboratory techniques have been developed for determining the longevity, hardiness, vigor, and mating potential, and sexual aggressiveness of a particular strain of screwworms. A strain of Mexican screwworm flies is being selected and adapted to laboratory rearing. Sterile males from this strain should be able to more effectively compete with native Mexican male flies.

The Florida strain of flies, which has been under continuous colonization in the laboratory for over 12 years, may have developed some undesirable behavioral traits because of the artificial conditions under which they have been reared for so many generations (over 150).

Nutritional Studies:

It was established in 1963 that larvae require 12 amino acids, choline, ribonucleic acid, cholesterol, 6 B vitamins, and a mixture of inorganic salts. Nutritional studies directed toward producing a longer lived, larger and more vigorous fly are being carried out.

Ecological Investigations:

The ultimate success of the screwworm eradication program depends upon outnumbering native populations of screwworm flies with irradiated flies.

This requires a knowledge of the local distribution and dispersal patterns of the flies under a variety of environmental conditions.

In northern Mexico, weather is an important factor affecting screwworm populations. Cold winters decimate populations in northern Chihuahua and Coachuila. Hot, dry weather limits screwworm activity in Tamaulipas and Nuevo Leon. In arid regions, there is a close correlation between periods of maximum rainfall and peak screwworm activity. A study on the effects of weather and other factors on the incidence of screwworms is in progress in southern Mexico. An Isopleth mapping system of correlating information on concentrations of screwworm cases with predictable patterns of dispersal is being studied by the ERD in estimating the requirements for sterile flies in that area.

Genetic Markers:

An intensive program has been in progress since 1961 to develop strains of genetically marked screwworm flies for research purposes or for use in the eradication program. Laboratory populations of normal flies as well as the progeny of female flies treated with substerilizing dosage of radiation or chemosterilants have been scanned for obvious mutants. Over 15 marked strains of flies with markers have been isolated and studied in the laboratory.

A pure-breeding strain of flies with genetically marked larvae is being maintained for possible field use. These larvae have a complete row of spines on the dorsum of the 11th segment. This row is always incomplete in native screwworms. This marker could be used to determine if any screwworm cases in the barrier zone originated from artificially reared flies. A speckled winged mutant is currently being used in field release to study dye marking technique and the behavior of screwworm flies in this field.

Chemosterilants:

Screwworms are one of the test species which the Entomology Research Division is using in a search for chemicals that can be used to induce sexual sterility in insects. Although it does not appear that a chemosterilant could be substituted for gamma radiation in the mass-rearing program, there is an excellent possibility that chemosterilants would be a valuable adjunct for use in maintaining a permanent barrier to the northward migration of screwworm flies. For example, if a safe chemosterilant could be used in combination with an attractant to sterilize wild flies in Southern Mexico, it might be possible to maintain a barrier in an area such as the Isthmus of Tehuantepec without releasing reared sterile males.

Of about 1000 compounds screened as chemosterilants, approximately 100 antimetabolites and alkylating agents induced sexual sterility in screwworm flies. Many of these active chemosterilants also produced adverse effects such as shortened life, lack of mating ability, etc. In general, the antimetabolites were active by preventing oviposition and the alkylating agents by preventing hatch. Recently ERD workers reported on three compounds which, in laboratory tests, meet the criteria that he established for a useful chemosterilant. Male flies sterilized by N,N'tetramethylenebis (1-aziridinecarboxamide) surpassed both radiosterilized and non-irradiated males in mating competitiveness by a factor of at least four, while males sterilized by bis(1-aziridinyl) (hexahydro-1H-azepin-1-yl) phosphine oxide or 1-(bis (1-aziridinyl)phosphinyl)-3-(3,4-dichlorophenyl) urea competed for mates about equally. The effects of these chemicals on higher animals is not presently known and further research will be needed before they can be tested under outdoor conditions.

Attractants:

Studies have revealed that native female screwworm flies are attracted to the male fly by a pheromone which is produced by the male. Current studies are directed towards isolating sufficient quantities of this pheromone to use in large scale field tests. Small scale field tests are being carried out in Mexico and laboratory tests continue at Mission.

Larvicides:

Over two hundred chemical compounds have been screened in an effort to discover an additional effective screwworm larvicide. Of the compounds which have been screened, 11 have been 100% effective against newly hatched larvae at concentrations lower than 1 ppm or approximately equal to coumaphos in effectiveness.

These compounds are listed below:

Bayer 29492	Methyl Trithion
29952	Monsanto CP-40273
30749	Shell Compound 4072
34098	Stauffer R-1448
fenthion	Stauffer N-2790
Hooker HRS-1422	

Screwworm Biological Studies:

The life cycle of the Mexican strain of screwworm flies is being carefully studied in the laboratory at Mission and in controlled field studies using live animals at Cotaxtla, Veracruz, Mexico.

Mr. McDuffie

Screw worm

Entomology Research Division
Kerrville, Texas

Repair and reconstruction of cage at Cotaxtla

R. B. Davis, Research Biologist

July 12, 1966

Through: B. G. Hightower, Entomologist in Charge
Livestock Insects Investigations
Mission, Texas

Confirming our conversation in Mission last week, I feel that you should arrange to proceed with repair and reconstruction of the cage at Cotaxtla at the earliest feasible date. Although our funds are very limited this fiscal year, I can approve your request for $80-$90 for roofing and nails, and an additional $100 for general repair of the cage.

We will be guests at the Cotaxtla station, and I feel that we should do whatever we can to make our presence and activities at the station acceptable to the management of the Experiment Station. If the installation of our facilities conforms with the overall plan which the director of the station has for the improvement of his facilities, we will almost certainly be more welcome at the station.

O. H. Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie

Entomology Research Division
Kerrville, Texas

Repair and reconstruction of cage at Cotaxtla

R. B. Davis, Research Biologist

July 12, 1966

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Livestock Insects Investigations
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O. H. Graham
Investigations Leader
Livestock Insects Investigations

cc:
W. C. McDuffie

Screwworm

July 19, 1966

To: O. H. Graham, P. O. Box 232, Kerrville, Texas 78028

From: W. C. McDuffie, Chief, Insects Affecting Man and Animals Research Branch

Subject: Screw-worm Research

I am enclosing a portion of a letter from Dr. Sharman to Dr. Meyer on the above subject. Dr. Knipling and I have discussed his proposals with Dr. Meyer and Dr. Williams. All of us agree that there is a need for increased research in Mexico. However, we feel the present part time effort in Mexico is about all we can do until additional funds are made available. Presumably such funds would be forthcoming if and when a joint U. S. - Mexico program is established.

Dr. Knipling suggested that I write to ask you and Dr. Hightower to outline the research that you feel would be needed and what would be required in the way of staff and funds. You might also consider where such a project might be most advantageously located in Mexico. When you are in Mexico City, it would be desirable if you and Dr. Hightower could consult with Dr. Sharman on these matters.

With the above information on hand, we would be in a good position to meet any emergency requests concerning our plans for research in support if a joint program develops.

cc: B. G. Hightower

ARS:ENT:WCMcduffie:rs

W. C. McDuffie

D.E.W.

July 19, 1966

To: O. H. Graham, P. O. Box 232, Kerrville, Texas 78028

From: W. C. McGuffie, Chief, Insects Affecting Man and Animals Research Branch

Subject: Screw-worm Research

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Dr. Knipling suggested that I write to ask you and Dr. Hightower to outline the research that you feel would be needed and what would be required in the way of staff and funds. You might also consider where such a project might be most advantageously located in Mexico. When you are in Mexico City, it would be desirable if you and Dr. Hightower could consult with Dr. Sherman on these matters.

With the above information on hand, we would be in a good position to meet any emergency requests concerning our plans for research in support if a joint program develops.

cc: B. G. Hightower

ARS:ENT:WCMcGuffie:rs

W. C. McGuffie

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SPECIAL REPORT K-71

The Effects of Releasing Sterile Screw-Worm Flies in Northern Vera Cruz, Mexico, as Measured by Recovery of Sterile Egg Masses

R. B. Davis, B. G. Hightower, D. A. Alley, J. E. Turner, E. Lopez, and R. W. Pratt

Prepared by the

Mission, Texas, Livestock Insects Investigations (Satellite laboratory of Kerrville, Texas)

Entomology Research Division
Agricultural Research Service
United States Department of Agriculture

August 9, 1966

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Introduction

Screw-worms [Cochliomyia hominivorax (Coquerel)] were eradicated from the southeastern United States several years ago. In that area, both natural and regulatory barriers help to prevent reintroduction of the pest. In the current eradication program in the southwestern United States, however, reintroduction of screw-worm flies from northern Mexico must be combated by continuous release of sterile flies over an extensive barrier zone.

The high cost of maintaining this barrier zone makes it necessary to constantly search for more efficient methods of rearing and dispensing sterile flies. One of the most promising ways to reduce costs of sterile fly dispersal is through decreasing flight time required by aircraft for effective dispersal of a load of sterile flies. One way to accomplish this is to increase the number of flies dropped per air mile, permitting fewer air miles of flight for treating a unit of ground surface. To make this change biologically effective, the distance between flight lanes must not exceed the natural ability of the sterile flies to disperse over the treated area.

A 1-mile distance between flight lanes, with 1000 sterile screw-worm flies per square mile per week, produced 70% sterile egg masses after 3 months in Florida (Baumhover, et al. 1959). In their test, conducted over a 2000-sq mile area, a 6-mile spacing of flight lanes was flown, with a 1-mile offset of the pattern each day to accomplish the weekly coverage. Release of 800 sterile flies per sq mile per week, flown on a similar pattern, had previously eradicated screw-worms from Curacao.

The current objective of the barrier zone in northern Mexico is control, not eradication, so significant savings may be possible through both increased distance between flight lanes and decreased numbers of sterile males per unit of treated area. The tests described herein include both these variables. The second test also attempted to measure the effect on fly quality of two media used for their rearing.

Test Specifications

In the 1964 test, the sterile flies were reared on nutria flesh or lungs of livestock. The distance between flight lanes was 8 miles, on a fixed pattern with no offsets. The density of released sterile flies was calculated at 400 sterile flies per sq mile, presuming even dispersion after release. An area of 2000 sq miles in northern Vera Cruz, Mexico, was used for the test. Wounded sheep, with screw-worm larvae in their wounds, were used to induce oviposition by the native screw-worm females. The test was conducted for three months during the summer and fall of 1964. Figure 1 shows the layout of the test area, with locations and numbers of the pens where wounded sheep were kept.

The second test was conducted in the same general area during late August 1965 through January 15, 1966. Two areas, each of about 2000 sq miles, and separated by a 12-mile wide barrier zone, were used to compare sterile flies raised on horsemeat with those raised on a liquid medium (6% dried blood and 1.9% dried milk in an aqueous mixture plus a 4:1 mixture of fish meal and dried milk). Flight lanes were separated by 12 miles, with no offsets, and the calculated sterile-fly density for even dispersion was set at 400 sterile flies per sq mile. Figure 2 shows the layout of the second test.

Northern Vera Cruz was selected as the experimental area because environmental conditions appeared favorable for screw-worm activity and it was far enough away from release areas in northern Mexico to prevent ingress of sterile-mated native or released flies. The test zone is bounded on the east by the Gulf of Mexico and on the west by the first uplift of the Sierra Madre Oriental Mountains. The terrain varied from a narrow strip of coastal plain on the east to rolling hills less than 200 meters above sea level in the central part. Much of the original tropical forest has been cleared for pastures or groves of citrus and other tropical fruits. Patches of original vegetation remain along some water courses and on some hill tops.

Most of the ranches are small, cross-fenced, and stocked almost exclusively with Zebu or Indu cattle, or their cross-breeds with Brown Swiss. Other domestic animals are horses, burros, pigs, and a few small flocks of sheep and goats. Rabbits, coyotes, racoons, and opossums are not uncommon but deer are scarce.

The climate of the area is classified by Thornthwaite as hot and humid. The natural vegetation is classified by S. Leopold as tropical evergreen. Temperatures vary between rare winter lows of about 5°C to infrequent summer highs of about 38°C, but the majority of diurnal variation is between 16°C and 32°C all year long. Annual rainfall is between 1000 and 2450 mm with the driest seasons normally occurring in late fall and spring.

The 1964 test fell during a period when rainfall was 50 to 75% below normal in the test area. The 1965 test experienced average or above rainfall and an early onset of low winter temperatures.

The screw-worm flies used in these test releases were reared, irradiated, and dispersed by techniques previously described (Graham and Dudley 1959, Baumhover et al. 1959).

The first release of the 1964 test was made on August 11, 1964, and 10 subsequent releases were made at 7-day intervals until October 27, 1964. An off-schedule release was made August 16, and no release was made during the week of September 26 through October 2, 1964.

In the 1965 test, the first full release was made on August 13 with 11 releases at weekly intervals thereafter, until October 27, 1965. Three additional releases were made on November 26, December 21, 1965, and January 6, 1966. Bad weather prevented complete coverage of the whole area on a weekly basis after October 27, 1965. The test was terminated in January due to cold weather.

Each of the sheep pens, located as shown in the layouts, Figs. 1 and 2, was stocked with 3 sheep. An effort was made to keep one animal infested with screw-worms and a second with a recently infested open wound at all times. The wounds were examined for egg masses daily, except Sundays in the first test, and daily in the second test. Each collected egg mass was held on moistened paper in a small plastic petri dish for 24 hr to allow fertile egg masses to hatch. Those which failed to hatch in 24 hr were held an additional 12 hr before a final determination of sterility was made.

Test Hypotheses

No precise preconceptions were made in the first test of what would constitute proof of 8-mile flight lanes and 400 sterile flies per sq mile as an effective system of eradicating screw-worms. Rather, the first test was planned as a brief study of how sterility rates would relate to seasons, topography and weather in a tropical area. Of course, a stable, high level of sterility would constitute proof of the system, but such a result was not anticipated. The distance between flight lanes was the widest ever used consistently in the program, and the density of sterile flies was half that used in the Florida tests. Appearance of consistent trends in low levels of sterility, relatable to natural events in the area, was expected to indicate the feasibility of the technique.

Because the first test did indicate that wide spacing of flight lanes at low density of sterile flies might be feasible, the second test was designed to test the idea more completely. A larger area was treated; more pens of sheep were used; the test covered a longer period. In addition, the effect of distance of sheep pens from flight lanes was more precisely sampled, and the two kinds of fly rearing media were compared.

Results

1964 Tests.--The weekly percentages of sterile egg masses collected from all pens along with the dates of the sterile fly releases are given in Fig. 2. After a peak of 68% sterile egg masses collected during the week ending October 2, total egg mass collections increased and the percent sterility declined. There were no significant differences in percentages of sterile egg masses from pens at 0, 1, 2, and 4 miles from the lines of release. Also,

there were no significant differences in percentages of sterility attributable to the distance of the animal pen from the center of the release zone.

The local distribution of the screw-worm populations as sampled by daily egg mass collections is shown in Fig. 3. Pens 1, 2, and 10 were located on the eastern side of the release zone. This area was isolated from reinfestation on the east side by the Gulf of Mexico and partially isolated on the north side by an area of extreme drought. Pens 3, 4, 5, and 9 were in the foothills on the western side of the release zone. These areas near the mountains received 3 more rains than the eastern areas during August and September. Pen 7 also received the additional rains. During the period from August 29 to November 6, an average of 43.1 egg masses per pen was obtained from the western pens compared to an average of 9.6 egg masses per pen from the eastern pens. The percentages of sterile egg masses were 25.8 in the former group and 62.0 in the latter. Thus, comparisons made between groups of pens without regard to the local distribution of the native populations of flies are of doubtful value.

1965 Test.--Weekly distribution of egg mass collections is given in Table 1 and Fig. 4. Figure 4 also illustrates the relation of weather to egg mass collections, with the significant weather variations expressed as daily minimum temperatures, degrees centigrade. The first sharp decrease in temperature - the first norther of the winter - occurred on October 2. Another came on October 23, with cool weather thereafter until November 5. After the next norther on November 30 only 3 days of warm weather, December 16-18, occurred during the remainder of the test. Rainfall at Tuxpan during the test was 322 mm in August; 174 mm in September; October, 234 mm; November, 92 mm; December, 37 mm; and January, 54 mm. Over 96 mm fell in August between the 9th and 12th with a dry spell for a week afterwards. Over 62 mm fell between the 1st and 8th of September, with a 2-week dry spell thereafter; then the first norther came in.

Discussion

1965 Test.--The ratio of sterile to total egg masses was more constant in this test than in the first one, as shown in graph G of Fig. 4. Highest percent sterility occurred on October 2 among the south pens, when total egg masses were low (see graph E, Fig. 4). Sterility levels never approached a level necessary for eradication. Sterility achieved in the area when horsemeat-reared flies were dropped averaged slightly higher than that for the other area, but not significantly so.

Weather had a marked effect on rate of egg deposition. Heavy rains during warm weather (above 25°C daily minima) depressed the rate of egg mass deposition. Cold spells, with minima below 20°C also caused flies to stop laying. The fact that many egg masses, both fertile and sterile, were laid up to 4 weeks after a release of sterile flies, as during the period October 22

through November 26 (see Fig. 4), indicates that neither heavy rains nor brief periods of cold weather in this area kill many native flies. It suggests that the released flies also may have long lives in this environment. Persistent cold weather, with daily minima below 20°C, stops egg laying and apparently kills many flies. This was the situation after December 31, 1965 (see Fig. 4).

The most significant clue to lack of success with the 12-mile flight lanes lies in comparison of the differences among sterilities for the sets of pens located at 0-mile, 3-miles, and 6-miles from the flight lanes (see Table 1 totals). There is a definite trend toward lower sterilities with increasing distance from the flight lanes. This indicates that the chances for production of sterile egg masses in the area under the flight lanes was almost three times what it was 6 miles away. It appears that one of the following trends may have dominated other events:

1. The sterile flies did not move far from the point of release, probably no more than 4-6 miles on the average; and the native female flies, even though they may move greater distances before mating, remain to lay their eggs in the vicinity after being sterile-mated.

2. Neither native or sterile flies move about much, perhaps less than 6-8 miles on the average.

The latter possibility is the more parsimonious one.

A clear conclusion from this test is that the use of live, wounded animals in this test as attractants for oviposition is an inefficient technique for collecting data on ratios of sterile to fertile egg masses. Many more pens of animals were needed, spread over much more of the test area. Yet even at the low costs for animals and feed, and for technical personnel in Mexico, the cost per egg mass collected was about $7.00, excluding salary of the senior investigators and costs of producing and dispersing the steril flies.

Table 1.--Comparison of ratios of numbers of fertile screw-worm egg masses to all screw-worm egg masses collected in 1965 test.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T[1]	F[2]	S[3]	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
	8/13																		
8/21		13	13	0	-	-	-	6	6	0	6	6	0	13	13	0	19	19	0
	8/25																		
8/28		37	37	0	-	-	-	34	34	0	43	43	0	28	28	0	71	71	0
	9/1																		
9/4		57	57	0	-	-	-	51	51	0	73	73	0	35	35	0	108	108	0
	9/8																		
9/11		19	19	0	-	-	-	35	34	2.8	13	13	0	41	40	2.4	54	53	1.8
	9/15																		
9/18		7	7	0	-	-	-	30	30	0	7	7	0	30	30	0	37	37	0
	9/22																		
9/25		47	37	21.3	-	-	-	35	34	2.8	20	13	35.0	62	58	6.4	82	71	13.4
	9/29																		
10/2		62	52	16.1	-	-	-	40	38	5.0	21	12	42.8	81	78	3.7	102	90	11.8
	10/6																		
10/9		21	20	4.8	-	-	-	48	46	4.2	10	9	10.0	59	57	3.4	69	66	4.3
	10/13	3-mile pens fully stocked, system of wounds working as in other pens																	
10/16		24	22	8.3	29	29		38	38	0	37	35	5.4	54	54	0	91	89	2.2
	10/22	Fly drop switched to horsemeat-reared in north zone, hydroponic reared in south zone																	
10/23		11	7	36.4	23	19	17.4	36	32	11.1	31	24	22.6	39	34	12.8	70	58	17.1
	10/27																		
10/29		2	2	0	25	22	12.0	24	22	8.3	25	20	20.0	26	26	0	51	46	9.8
11/5		11	11	0	11	11	0	15	15	0	26	26	0	11	11	0	37	37	0
11/12		3	1	66.7	13	12	7.7	20	17	15.0	27	21	22.2	9	9	0	36	30	16.7
11/19		41	26	36.6	39	30	23.1	48	44	8.3	78	65	16.7	50	35	30.0	128	100	21.9
11/26	11/26	23	22	4.3	30	29	3.3	43	40	7.5	45	41	8.9	51	50	2.0	96	91	5.2
12/3		13	12	7.7	25	24	4.0	35	35	0	27	26	3.7	46	45	2.2	73	71	2.7
	12/6																		
12/10		4	3	25.0	23	19	17.4	27	23	14.8	28	25	10.7	26	20	23.1	54	45	16.7
12/17		26	22	15.4	8	8	0	20	20	0	24	21	12.5	30	29	3.3	54	50	7.4
	12/21																		
12/24		24	23	4.2	18	18	0	16	16	0	31	30	3.2	27	27	0	58	57	1.7

Table 3.--Comparison of ratios of numbers of fertile screw-worm egg masses to all screw-worm egg masses collected in 1965 tests.

Dates		6 Head												6-9 Years						12-18 Years			
Collection	Ratio	(1) 8-Miles				(2) 5-Miles				(3) 3-Miles				(4) 3n. Zone				(5) 7n. Zone					
Time	Date	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	6/13																						
6/21		13	73	0	-	-	-	-	6	6	6	6	0	13	13	0	19	19	0				
	6/25																						
6/28		37	37	0	-	-	-	-	34	34	0	43	43	0	28	28	0	21	21	0			
	9/1																						
9/4		57	57	0	-	-	-	-	51	51	0	73	73	0	35	35	0	108	108	0			
	9/8																						
9/11		19	19	0	-	-	-	-	35	34	2.9	13	13	0	41	40	2.4	34	33	1.8			
	9/15																						
9/18		7	7	0	-	-	-	-	30	30	0	7	7	0	30	30	0	37	37	0			
	9/22																						
9/25		47	37	21.3	-	-	-	-	35	34	2.8	20	13	35.0	52	58	6.4	82	71	13.4			
	9/29																						
10/2		82	32	16.1	-	-	-	-	40	38	5.0	21	12	42.8	81	78	3.7	102	90	11.8			
	10/6																						
10/9		31	20	4.8	-	-	-	-	48	46	4.2	10	9	10.0	59	57	3.4	69	66	4.3			
	10/13	3-mile pens fully stocked, system of wounds working as in other pens																					
10/16		24	22	8.3	19	23			38	38	0	37	33	7.4	34	34	0	91	89	2.2			
	10/22	Fly drop switches to northeast-trend in north area, hydrogenic trend in south zone																					
10/23		11	7	36.4	23	19	17.4	10	32	31.1	31	26	22.5	39	34	12.8	70	58	17.1				
	10/27																						
10/28		2	2	0	25	22	12.0	34	22	4.3	35	30	20.0	24	26	0	41	45	9.8				
11/1		41	11	0	11	11	0	15	15	0	19	19	0	11	11	0	37	37	0				
11/12		3	1	66.7	13	12	7.7	20	17	15.0	17	13	23.2	9	9	0	30	30	16.7				
11/15		42	35	16.7	39	30	23.1	44	44	0.2	75	65	16.7	30	25	30.0	122	100	21.9				
11/26	11/29	23	22	4.7	30	29	3.3	53	40	7.5	45	41	9.3	51	30	2.0	96	91	5.2				
12/3		12	12	7.7	25	24	4.0	35	35	0	27	26	3.7	46	45	2.2	13	11	8.7				
	12/6																						
12/10		6	3	25.0	21	19	17.6	27	23	14.8	28	25	10.7	24	20	23.1	34	45	16.7				
12/17		34	29	15.4	4	8	0	26	20	0	44	31	12.5	30	29	3.3	54	50	7.4				
	12/21																						
12/24		24	23	4.2	19	18	0	16	14	0	31	30	3.2	27	27	0	56	57	1.7				

Table 1.--Cont'd.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T 1/	F 2/	S 3/	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
12/31		11	11	0	12	12	0	7	7	0	11	11	0	19	19	0	30	30	00
1/7	1/6	11	11	0	7	7	0	14	14	0	15	15	0	17	17	0	32	32	0
1/14		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		467	415	11.1	263	240	8.5	622	596	4.1	598	536	10.4	754	715	5.2	1352	1251	7.5

1/ T = Total number of screw-worm egg masses collected.
2/ F = Number of fertile screw-worm egg masses collected.
3/ S = Percent sterile screw-worm egg masses collected.

Table 1.--Cont'd.

Dates collected	Fly drop	6 years (2) 0-Miles 1/ T	2/	3/	(3) 3-Miles T	2/	3/	(4) 6-Miles T	2/	3/	8-9 years (5) Ab. Zone T	2/	3/	(6) Mb. Zone T	2/	3/	12-13 years (8) Mouth Cones T	2/	3/
12/31		11	11	0	13	12	0	7	7	0	11	11	0	19	19	0	30	30	00
1/7	1/6	11	11	0	7	7	0	16	16	0	15	15	0	17	17	0	32	32	0
1/14		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		447	415	11.1	241	240	2.5	612	596	4.1	595	536	10.4	754	715	5.2	1352	1251	7.5

1/ T = Total number of screw-worm egg masses collected.
2/ F = Number of fertile screw-worm egg masses collected.
3/ S = Percent sterile screw-worm egg masses collected.

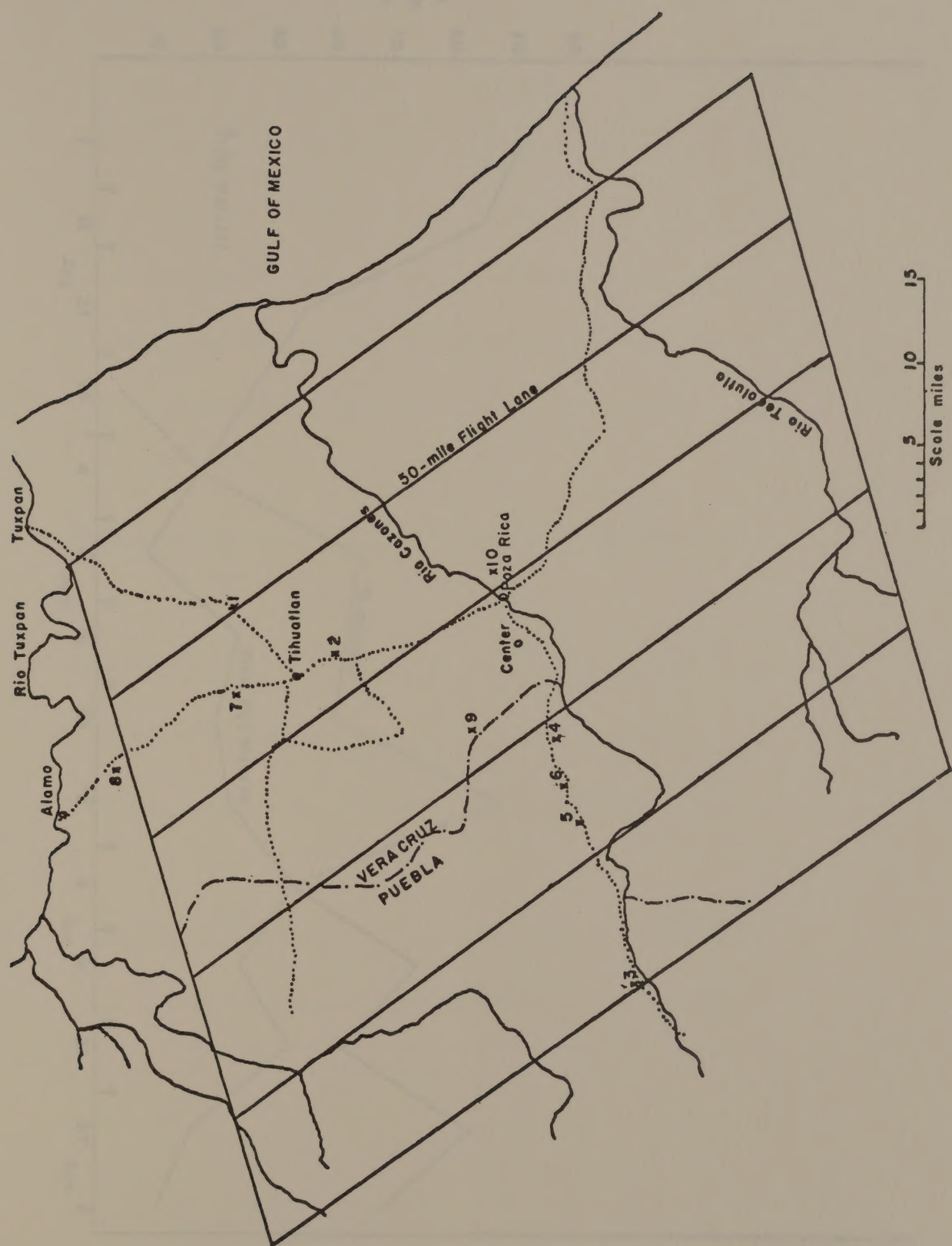

Fig. 1.--Locations of sheep pens in the 1964 experiment in northern Vera Cruz.

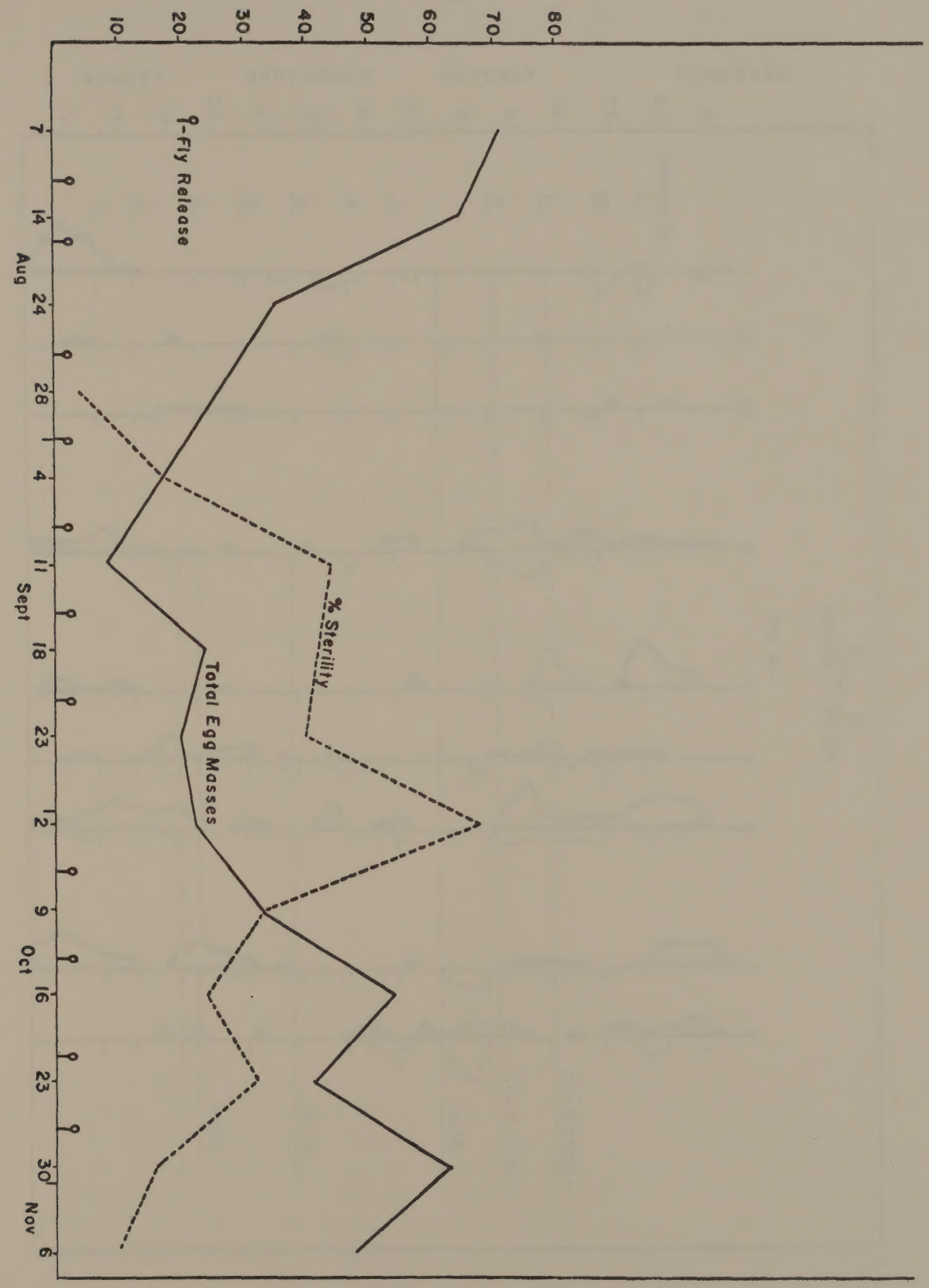

Fig. 2.--Weekly percentages of sterile screw-worm egg masses compared with total egg mass collections, Vera Cruz, 1964.

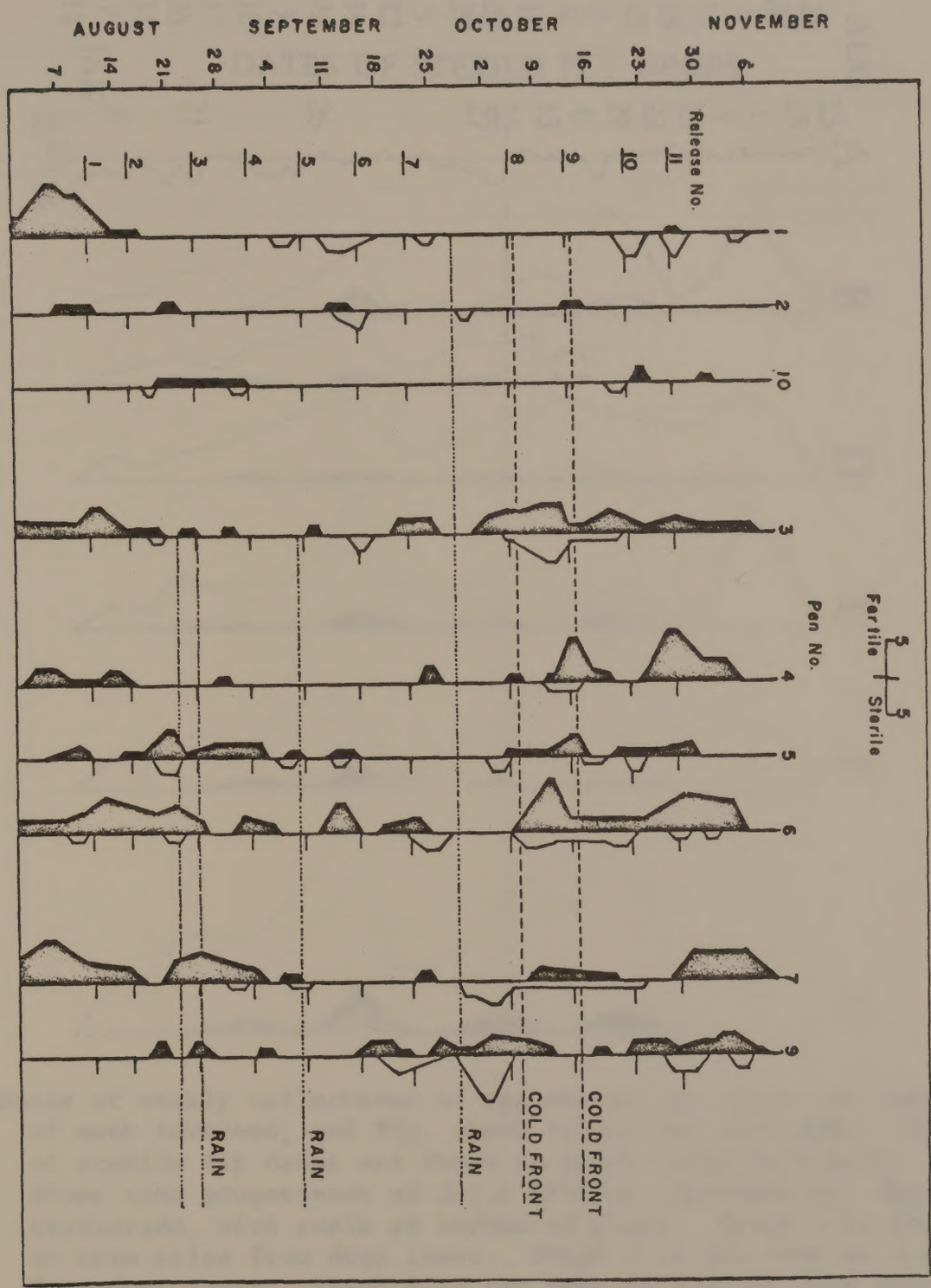

Fig. 3.--Numbers of fertile and sterile screw-worm egg masses collected from individual pens, Vera Cruz, 1964.

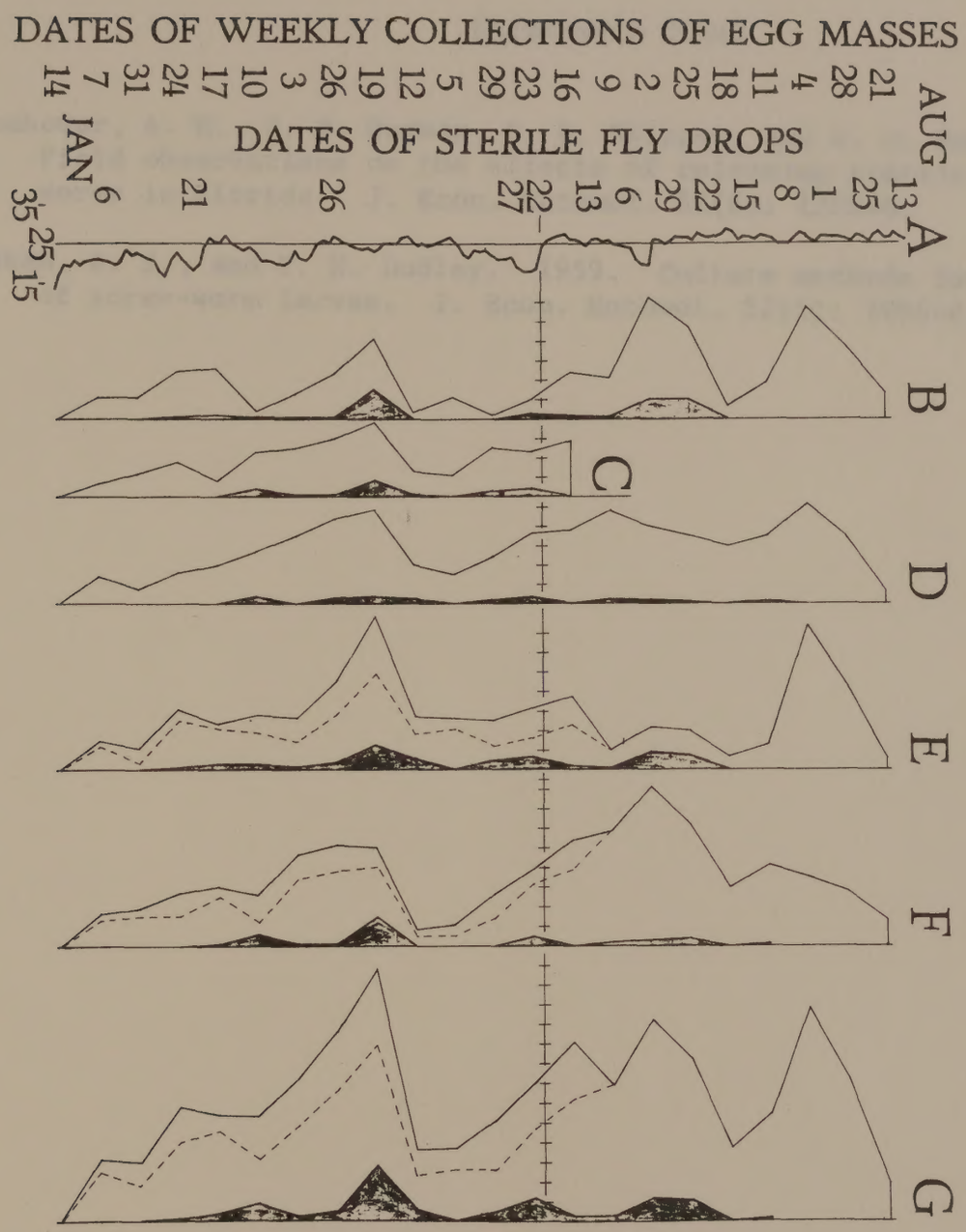

Fig. 4.--Dates of weekly collections of egg masses are those for last day of week involved, and Fig. shows totals for each week. Dates of sterile fly drops are those on which drops were made. Graph A shows time progression of daily minimum temperatures, degrees centigrade, with scale at bottom of graph. Graph B is for pens at zero miles from drop lanes. Graph C is for pens at 3 miles from drop lanes. Graph D is for pens at 6 miles from drop lanes. Graph E is for all pens in south zone. Graph F is for all pens in north zone. Graph G is for all pens together. Dotted lines in graphs E, F, and G are for pens at zero and 6 miles only. Scale for graphs B-G is shown as horizontal mid-line, each unit representing 10 egg masses.

Literature Cited

Baumhover, A. H., C. N. Husman, C. C. Skipper, and W. D. New. 1959. Field observations on the effects of releasing sterile screw-worms in Florida. J. Econ. Entomol. 52(6): 1202-6.

Graham, A. J., and F. H. Dudley. 1959. Culture methods for mass rearing of screw-worm larvae. J. Econ. Entomol. 52(5): 1096-8.

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Most of the ranches are small, cross-fenced, and stocked almost exclusively with Zebu or Indu cattle, or their cross-breeds with Brown Swiss. Other domestic animals are horses, burros, pigs, and a few small flocks of sheep and goats. Rabbits, coyotes, racoons, and opossums are not uncommon but deer are scarce.

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Each of the sheep pens, located as shown in the layouts, Figs. 1 and 2, was stocked with 3 sheep. An effort was made to keep one animal infested with screw-worms and a second with a recently infested open wound at all times. The wounds were examined for egg masses daily, except Sundays in the first test, and daily in the second test. Each collected egg mass was held on moistened paper in a small plastic petri dish for 24 hr to allow fertile egg masses to hatch. Those which failed to hatch in 24 hr were held an additional 12 hr before a final determination of sterility was made.

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No precise preconceptions were made in the first test of what would constitute proof of 8-mile flight lanes and 400 sterile flies per sq mile as an effective system of eradicating screw-worms. Rather, the first test was planned as a brief study of how sterility rates would relate to seasons, topography and weather in a tropical area. Of course, a stable, high level of sterility would constitute proof of the system, but such a result was not anticipated. The distance between flight lanes was the widest ever used consistently in the program, and the density of sterile flies was half that used in the Florida tests. Appearance of consistent trends in low levels of sterility, relatable to natural events in the area, was expected to indicate the feasibility of the technique.

Because the first test did indicate that wide spacing of flight lanes at low density of sterile flies might be feasible, the second test was designed to test the idea more completely. A larger area was treated; more pens of sheep were used; the test covered a longer period. In addition, the effect of distance of sheep pens from flight lanes was more precisely sampled, and the two kinds of fly rearing media were compared.

Results

1964 Tests.--The weekly percentages of sterile egg masses collected from all pens along with the dates of the sterile fly releases are given in Fig. 2. After a peak of 68% sterile egg masses collected during the week ending October 2, total egg mass collections increased and the percent sterility declined. There were no significant differences in percentages of sterile egg masses from pens at 0, 1, 2, and 4 miles from the lines of release. Also,

there were no significant differences in percentages of sterility attributable to the distance of the animal pen from the center of the release zone.

The local distribution of the screw-worm populations as sampled by daily egg mass collections is shown in Fig. 3. Pens 1, 2, and 10 were located on the eastern side of the release zone. This area was isolated from reinfestation on the east side by the Gulf of Mexico and partially isolated on the north side by an area of extreme drought. Pens 3, 4, 5, and 9 were in the foothills on the western side of the release zone. These areas near the mountains received 3 more rains than the eastern areas during August and September. Pen 7 also received the additional rains. During the period from August 29 to November 6, an average of 43.1 egg masses per pen was obtained from the western pens compared to an average of 9.6 egg masses per pen from the eastern pens. The percentages of sterile egg masses were 25.8 in the former group and 62.0 in the latter. Thus, comparisons made between groups of pens without regard to the local distribution of the native populations of flies are of doubtful value.

1965 Test.--Weekly distribution of egg mass collections is given in Table 1 and Fig. 4. Figure 4 also illustrates the relation of weather to egg mass collections, with the significant weather variations expressed as daily minimum temperatures, degrees centigrade. The first sharp decrease in temperature - the first norther of the winter - occurred on October 2. Another came on October 23, with cool weather thereafter until November 5. After the next norther on November 30 only 3 days of warm weather, December 16-18, occurred during the remainder of the test. Rainfall at Tuxpan during the test was 322 mm in August; 174 mm in September; October, 234 mm; November, 92 mm; December, 37 mm; and January, 54 mm. Over 96 mm fell in August between the 9th and 12th with a dry spell for a week afterwards. Over 62 mm fell between the 1st and 8th of September, with a 2-week dry spell thereafter; then the first norther came in.

Discussion

1965 Test.--The ratio of sterile to total egg masses was more constant in this test than in the first one, as shown in graph G of Fig. 4. Highest percent sterility occurred on October 2 among the south pens, when total egg masses were low (see graph E, Fig. 4). Sterility levels never approached a level necessary for eradication. Sterility achieved in the area when horsemeat-reared flies were dropped averaged slightly higher than that for the other area, but not significantly so.

Weather had a marked effect on rate of egg deposition. Heavy rains during warm weather (above 25°C daily minima) depressed the rate of egg mass deposition. Cold spells, with minima below 20°C also caused flies to stop laying. The fact that many egg masses, both fertile and sterile, were laid up to 4 weeks after a release of sterile flies, as during the period October 22

through November 26 (see Fig. 4), indicates that neither heavy rains nor brief periods of cold weather in this area kill many native flies. It suggests that the released flies also may have long lives in this environment. Persistent cold weather, with daily minima below 20°C, stops egg laying and apparently kills many flies. This was the situation after December 31, 1965 (see Fig. 4).

The most significant clue to lack of success with the 12-mile flight lanes lies in comparison of the differences among sterilities for the sets of pens located at 0-mile, 3-miles, and 6-miles from the flight lanes (see Table 1 totals). There is a definite trend toward lower sterilities with increasing distance from the flight lanes. This indicates that the chances for production of sterile egg masses in the area under the flight lanes was almost three times what it was 6 miles away. It appears that one of the following trends may have dominated other events:

1. The sterile flies did not move far from the point of release, probably no more than 4-6 miles on the average; and the native female flies, even though they may move greater distances before mating, remain to lay their eggs in the vicinity after being sterile-mated.

2. Neither native or sterile flies move about much, perhaps less than 6-8 miles on the average.

The latter possibility is the more parsimonious one.

A clear conclusion from this test is that the use of live, wounded animals in this test as attractants for oviposition is an inefficient technique for collecting data on ratios of sterile to fertile egg masses. Many more pens of animals were needed, spread over much more of the test area. Yet even at the low costs for animals and feed, and for technical personnel in Mexico, the cost per egg mass collected was about $7.00, excluding salary of the senior investigators and costs of producing and dispersing the steril flies.

Table 1.--Comparison of ratios of numbers of fertile screw-worm egg masses to all screw-worm egg masses collected in 1965 test.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T[1]	F[2]	S[3]	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
	8/13																		
8/21		13	13	0	-	-	-	6	6	0	6	6	0	13	13	0	19	19	0
	8/25																		
8/28		37	37	0	-	-	-	34	34	0	43	43	0	28	28	0	71	71	0
	9/1																		
9/4		57	57	0	-	-	-	51	51	0	73	73	0	35	35	0	108	108	0
	9/8																		
9/11		19	19	0	-	-	-	35	34	2.8	13	13	0	41	40	2.4	54	53	1.8
	9/15																		
9/18		7	7	0	-	-	-	30	30	0	7	7	0	30	30	0	37	37	0
	9/22																		
9/25		47	37	21.3	-	-	-	35	34	2.8	20	13	35.0	62	58	6.4	82	71	13.4
	9/29																		
10/2		62	52	16.1	-	-	-	40	38	5.0	21	12	42.8	81	78	3.7	102	90	11.8
	10/6																		
10/9		21	20	4.8	-	-	-	48	46	4.2	10	9	10.0	59	57	3.4	69	66	4.3
	10/13	3-mile pens fully stocked, system of wounds working as in other pens																	
10/16		24	22	8.3	29	29		38	38	0	37	35	5.4	54	54	0	91	89	2.2
	10/22	Fly drop switched to horsemeat-reared in north zone, hydroponic reared in south zone																	
10/23		11	7	36.4	23	19	17.4	36	32	11.1	31	24	22.6	39	34	12.8	70	58	17.1
	10/27																		
10/29		2	2	0	25	22	12.0	24	22	8.3	25	20	20.0	26	26	0	51	46	9.8
11/5		11	11	0	11	11	0	15	15	0	26	26	0	11	11	0	37	37	0
11/12		3	1	66.7	13	12	7.7	20	17	15.0	27	21	22.2	9	9	0	36	30	16.7
11/19		41	26	36.6	39	30	23.1	48	44	8.3	78	65	16.7	50	35	30.0	128	100	21.9
11/26	11/26	23	22	4.3	30	29	3.3	43	40	7.5	45	41	8.9	51	50	2.0	96	91	5.2
12/3		13	12	7.7	25	24	4.0	35	35	0	27	26	3.7	46	45	2.2	73	71	2.7
	12/6																		
12/10		4	3	25.0	23	19	17.4	27	23	14.8	28	25	10.7	26	20	23.1	54	45	16.7
12/17		26	22	15.4	8	8	0	20	20	0	24	21	12.5	30	29	3.3	54	50	7.4
	12/21																		
12/24		24	23	4.2	18	18	0	16	16	0	31	30	3.2	27	27	0	58	57	1.7

Table 1.--Comparison of ratios of numbers of fertile screw-worm egg masses in all screw-worm egg masses collected in 1955 test.

Dates	6 Pens																							
Release	Fly	(B) 0-Miles				(C) 3-Miles				(D) 6-Miles				6-9 Pens								12-18 Pens		
														(E) So. Zone				(F) No. Zone				(G) Both Zones		
Stone	Date	1/	2/	3/	4/	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3
	8/12																							
8/21		13	13	0	-	-	-	-	-	6	6	0	6	6	0	13	13	0	13	19	14	0		
	8/25																							
8/26		37	37	0	-	-	-	-	-	34	34	0	43	43	0	26	26	0	71	71	0			
	9/1																							
9/4		57	57	0	-	-	-	-	-	51	51	0	73	73	0	33	33	0	108	108	0			
	9/8																							
9/11		15	15	0	-	-	-	-	-	35	34	2.8	13	13	0	41	40	2.4	54	53	1.8			
	9/15																							
9/16		7	7	0	-	-	-	-	-	30	30	0	7	7	0	30	30	0	37	37	0			
	9/22																							
9/23		47	37	21.3	-	-	-	-	-	34	24	2.8	20	13	35.0	62	38	6.4	82	71	13.4			
	9/25																							
10/2		42	42	16.1	-	-	-	-	-	40	35	5.0	21	12	42.8	81	78	3.7	102	90	11.8			
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	10/13	3-mile pens fully stocked, systems of wounds working as in other pens																						
10/16		24	22	8.3	29					38	35	0	37	35	3.4	56	54	0	91	89	2.2			
	10/22	Fly drop switched to boxes-mast-tested in north zone, hydroponic reared in south zone																						
10/23		11	7	36.4	23	19	17.4	36	32	11.1	31	24	22.6	39	34	12.8	70	58	17.1					
	10/27																							
10/30		2	2	0	35	22	12.0	24	22	8.3	23	20	20.0	26	26	0	51	46	9.8					
11/3		11	11	0	21	11	0	15	13	0	26	26	0	11	11	0	37	37	0					
11/6		3	1	66.7	13	12	7.7	20	17	15.0	27	21	22.2	9	9	0	36	30	16.7					
11/9		41	26	36.6	39	30	23.1	48	44	8.3	28	45	16.7	50	35	30.0	128	100	21.9					
11/14		22	22	0	29	29	0	42	40	4.5	45	41	8.9	51	50	2.0	96	91	5.2					
11/15		13	12	7.1	45	34	4.0	35	35	0	27	24	3.7	44	45	2.2	73	71	2.7					
11/18		4	3	25.0	23	19	17.4	27	23	14.8	28	25	10.7	26	20	23.1	54	45	16.7					
11/21		24	22	15.4	8	8	0	20	20	0	24	21	12.5	30	29	3.3	34	30	7.4					
11/24		24	23	4.2	18	18	0	16	16	0	31	30	3.2	27	27	0	58	57	1.7					

Table 1.--Cont'd.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T[1/]	F[2/]	S[3/]	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
12/31		11	11	0	12	12	0	7	7	0	11	11	0	19	19	0	30	30	00
1/7	1/6	11	11	0	7	7	0	14	14	0	15	15	0	17	17	0	32	32	0
1/14		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		467	415	11.1	263	240	8.5	622	596	4.1	598	536	10.4	754	715	5.2	1352	1251	7.5

1/ T = Total number of screw-worm egg masses collected.
2/ F = Number of fertile screw-worm egg masses collected.
3/ S = Percent sterile screw-worm egg masses collected.

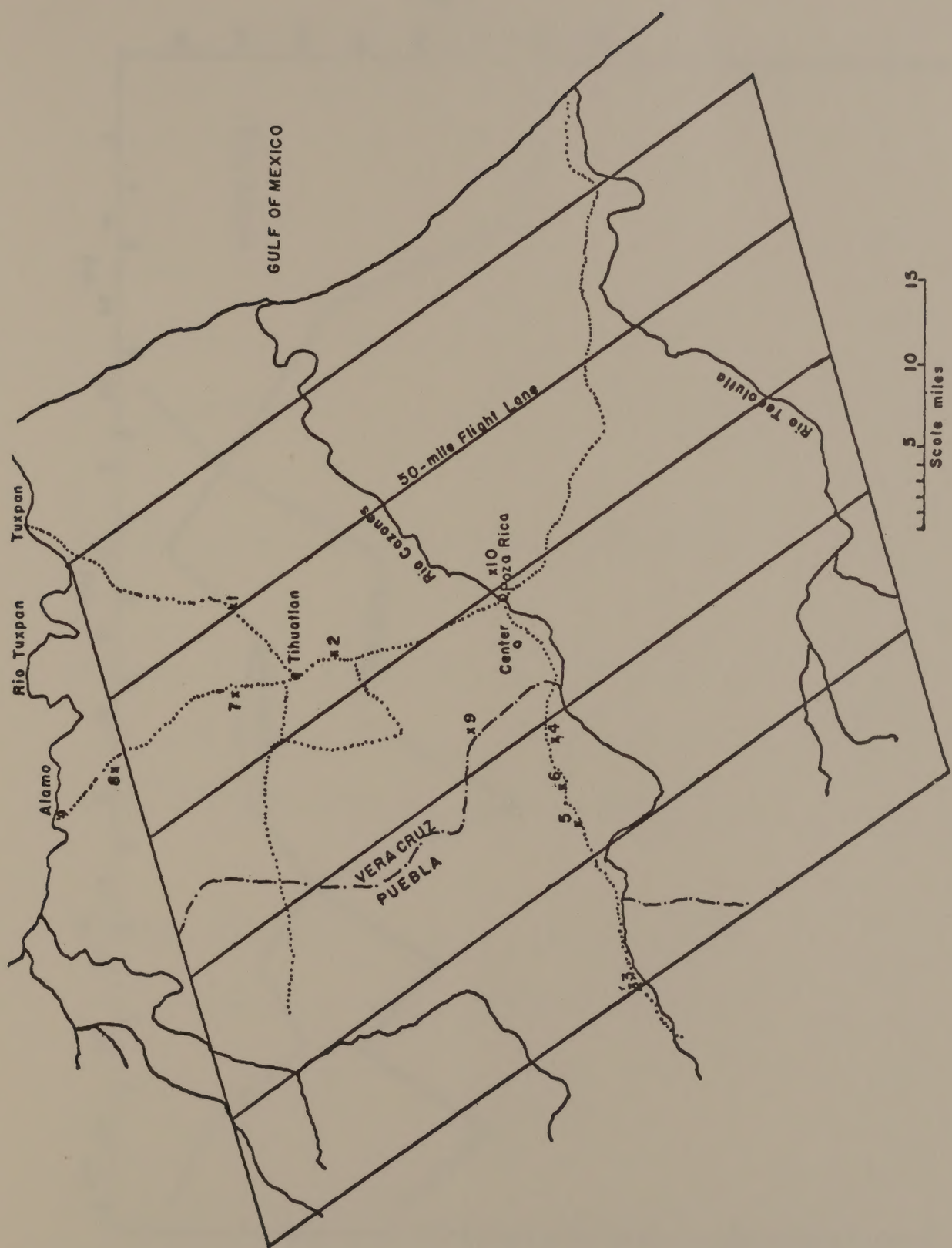
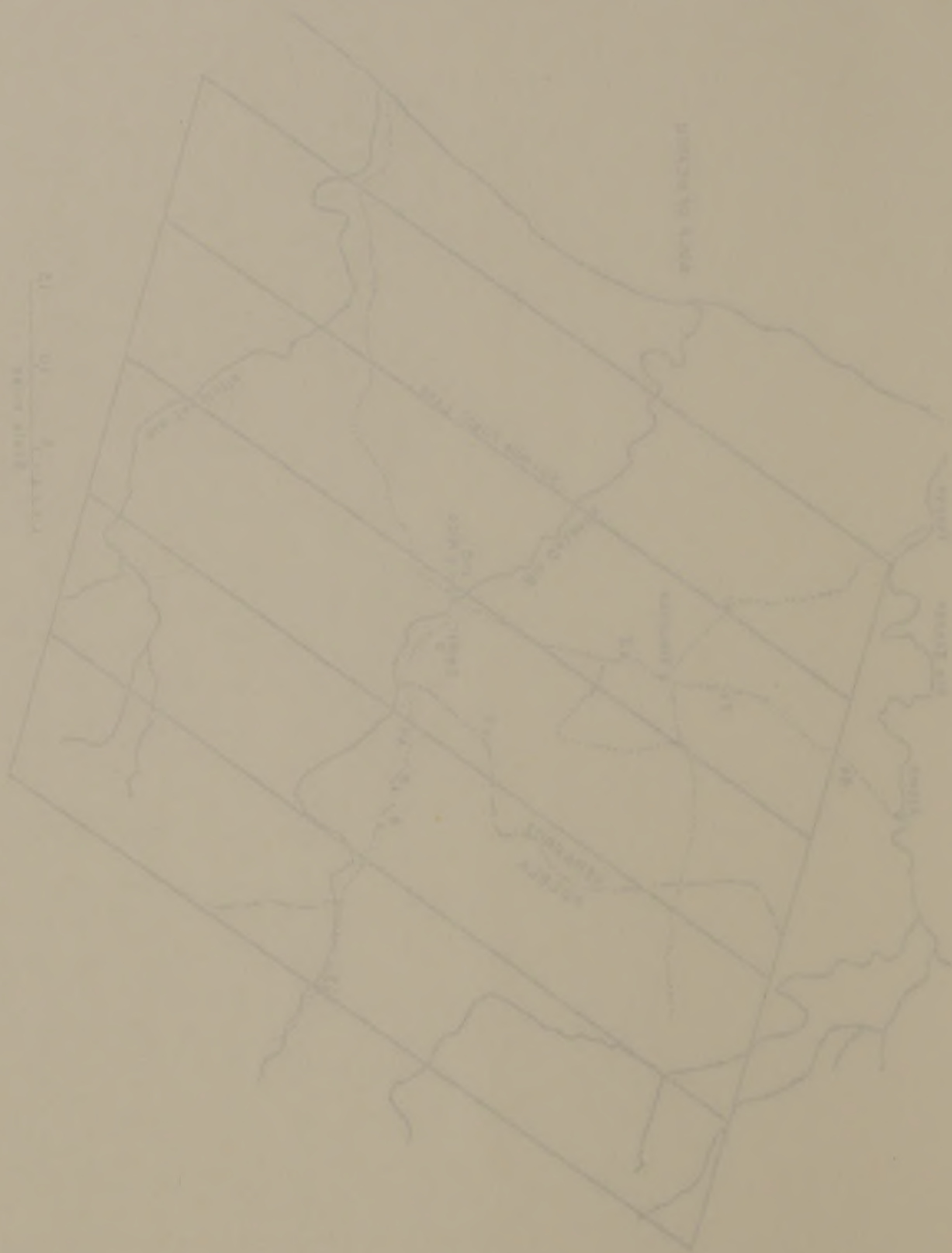


Fig. 1.--Locations of sheep pens in the 1964 experiment in northern Vera Cruz.



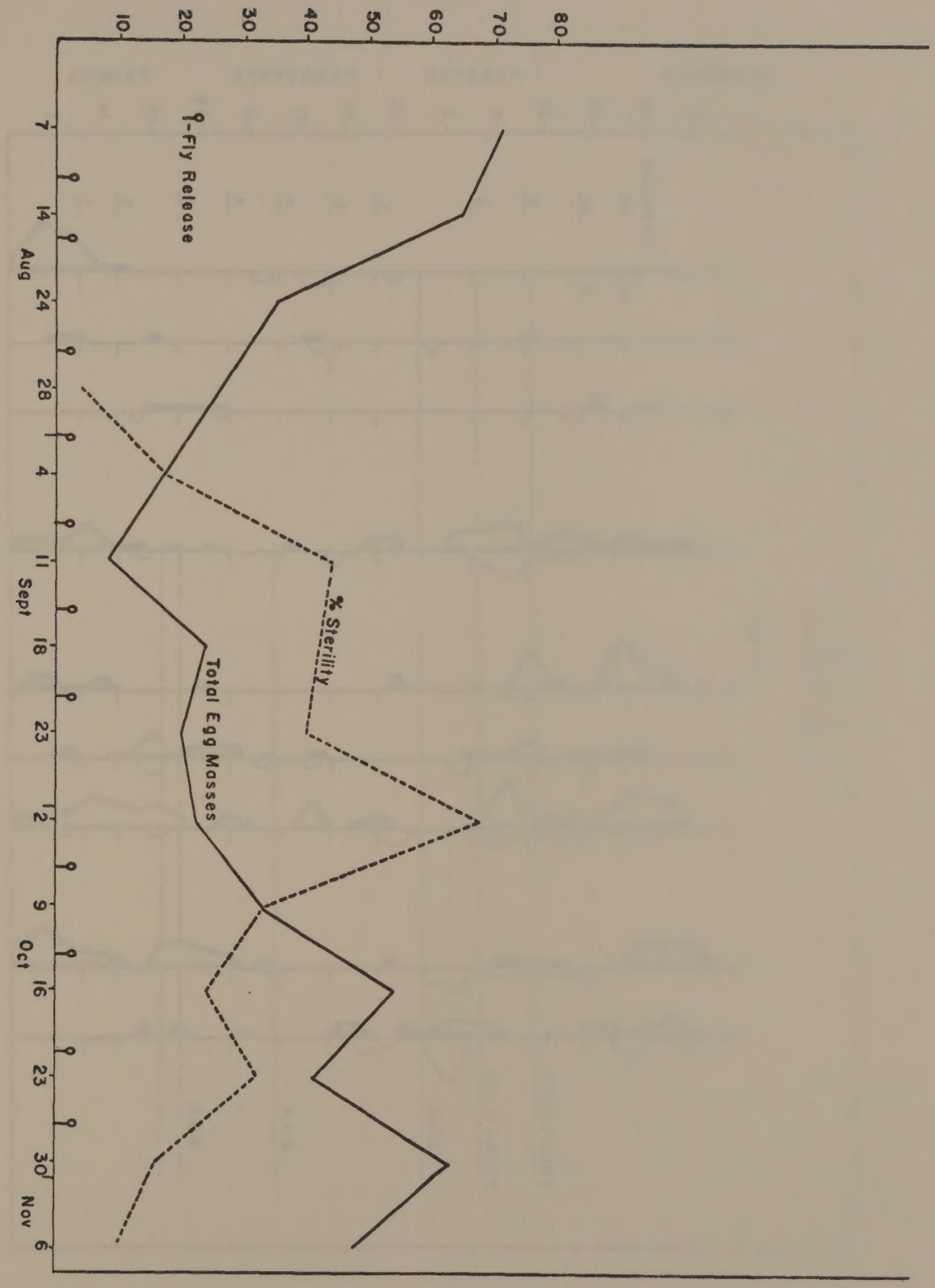


Fig. 2.--Weekly percentages of sterile screw-worm egg masses compared with total egg mass collections, Vera Cruz, 1964.

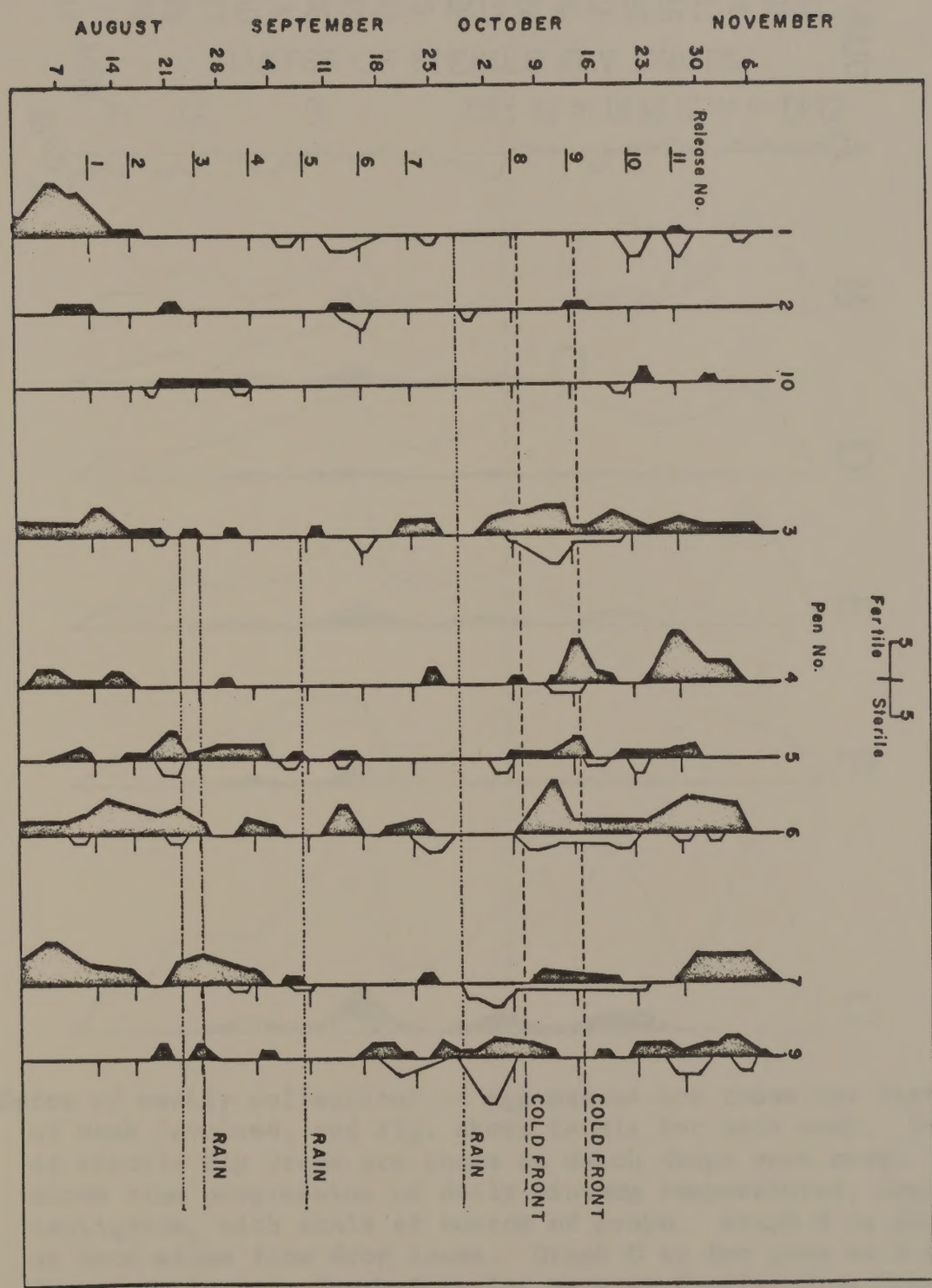


Fig. 3.--Numbers of fertile and sterile screw-worm egg masses collected from individual pens, Vera Cruz, 1964.

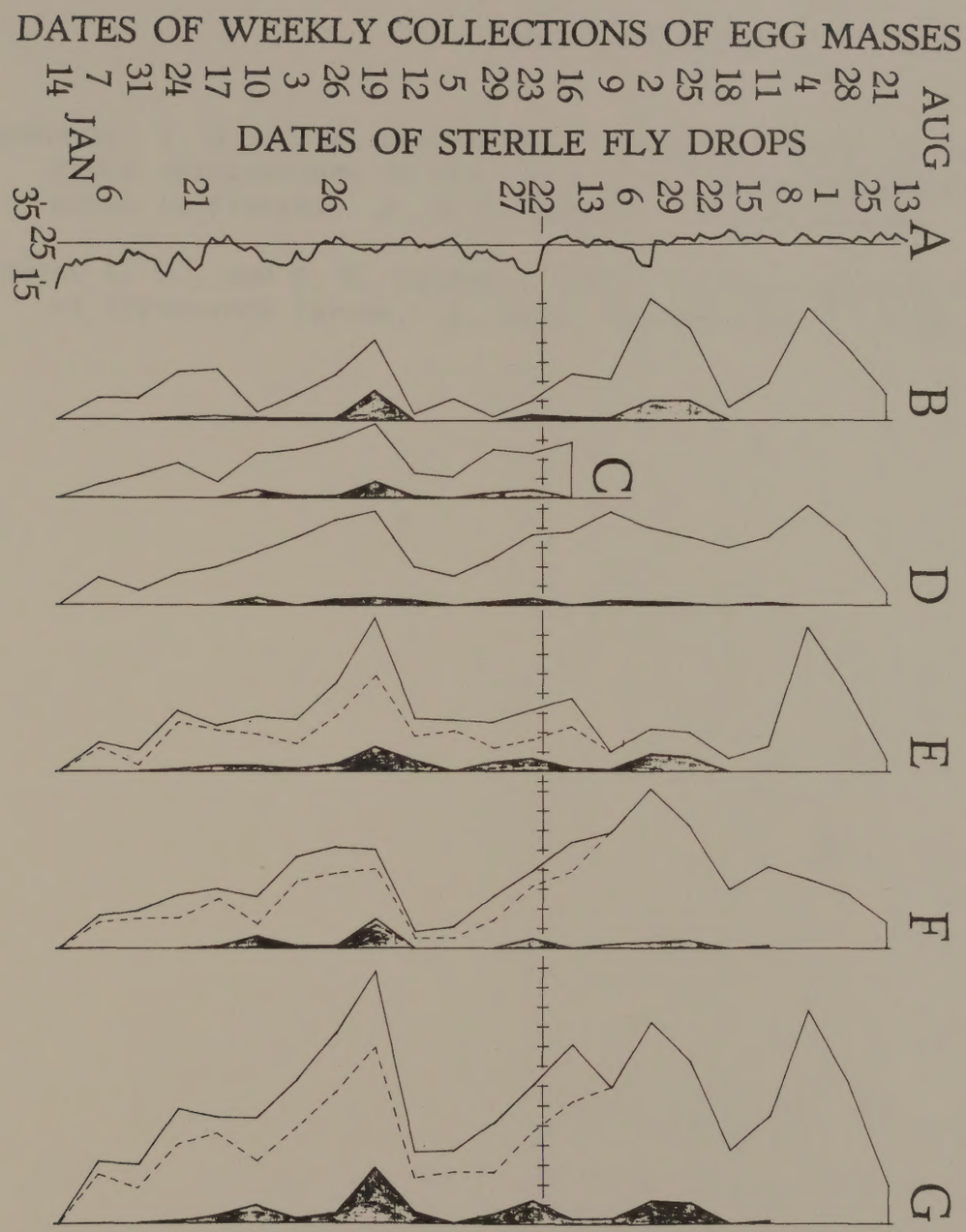


Fig. 4.--Dates of weekly collections of egg masses are those for last day of week involved, and Fig. shows totals for each week. Dates of sterile fly drops are those on which drops were made. Graph A shows time progression of daily minimum temperatures, degrees centigrade, with scale at bottom of graph. Graph B is for pens at zero miles from drop lanes. Graph C is for pens at 3 miles from drop lanes. Graph D is for pens at 6 miles from drop lanes. Graph E is for all pens in south zone. Graph F is for all pens in north zone. Graph G is for all pens together. Dotted lines in graphs E, F, and G are for pens at zero and 6 miles only. Scale for graphs B-G is shown as horizontal mid-line, each unit representing 10 egg masses.

Literature Cited

Baumhover, A. H., C. N. Husman, C. C. Skipper, and W. D. New. 1959. Field observations on the effects of releasing sterile screw-worms in Florida. J. Econ. Entomol. 52(6): 1202-6.

Graham, A. J., and F. H. Dudley. 1959. Culture methods for mass rearing of screw-worm larvae. J. Econ. Entomol. 52(5): 1096-8.

File Screw-worm

ADMINISTRATIVELY CONFIDENTIAL

SPECIAL REPORT K-71

The Effects of Releasing Sterile Screw-Worm Flies in Northern Vera Cruz, Mexico, as Measured by Recovery of Sterile Egg Masses

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Entomology Research Division
Agricultural Research Service
United States Department of Agriculture

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Introduction

Screw-worms [Cochliomyia hominivorax (Coquerel)] were eradicated from the southeastern United States several years ago. In that area, both natural and regulatory barriers help to prevent reintroduction of the pest. In the current eradication program in the southwestern United States, however, reintroduction of screw-worm flies from northern Mexico must be combated by continuous release of sterile flies over an extensive barrier zone.

The high cost of maintaining this barrier zone makes it necessary to constantly search for more efficient methods of rearing and dispensing sterile flies. One of the most promising ways to reduce costs of sterile fly dispersal is through decreasing flight time required by aircraft for effective dispersal of a load of sterile flies. One way to accomplish this is to increase the number of flies dropped per air mile, permitting fewer air miles of flight for treating a unit of ground surface. To make this change biologically effective, the distance between flight lanes must not exceed the natural ability of the sterile flies to disperse over the treated area.

A 1-mile distance between flight lanes, with 1000 sterile screw-worm flies per square mile per week, produced 70% sterile egg masses after 3 months in Florida (Baumhover, et al. 1959). In their test, conducted over a 2000-sq mile area, a 6-mile spacing of flight lanes was flown, with a 1-mile offset of the pattern each day to accomplish the weekly coverage. Release of 800 sterile flies per sq mile per week, flown on a similar pattern, had previously eradicated screw-worms from Curacao.

The current objective of the barrier zone in northern Mexico is control, not eradication, so significant savings may be possible through both increased distance between flight lanes and decreased numbers of sterile males per unit of treated area. The tests described herein include both these variables. The second test also attempted to measure the effect on fly quality of two media used for their rearing.

Test Specifications

In the 1964 test, the sterile flies were reared on nutria flesh or lungs of livestock. The distance between flight lanes was 8 miles, on a fixed pattern with no offsets. The density of released sterile flies was calculated at 400 sterile flies per sq mile, presuming even dispersion after release. An area of 2000 sq miles in northern Vera Cruz, Mexico, was used for the test. Wounded sheep, with screw-worm larvae in their wounds, were used to induce oviposition by the native screw-worm females. The test was conducted for three months during the summer and fall of 1964. Figure 1 shows the layout of the test area, with locations and numbers of the pens where wounded sheep were kept.

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Most of the ranches are small, cross-fenced, and stocked almost exclusively with Zebu or Indu cattle, or their cross-breeds with Brown Swiss. Other domestic animals are horses, burros, pigs, and a few small flocks of sheep and goats. Rabbits, coyotes, racoons, and opossums are not uncommon but deer are scarce.

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Results

1964 Tests.--The weekly percentages of sterile egg masses collected from all pens along with the dates of the sterile fly releases are given in Fig. 2. After a peak of 68% sterile egg masses collected during the week ending October 2, total egg mass collections increased and the percent sterility declined. There were no significant differences in percentages of sterile egg masses from pens at 0, 1, 2, and 4 miles from the lines of release. Also,

there were no significant differences in percentages of sterility attributable to the distance of the animal pen from the center of the release zone.

The local distribution of the screw-worm populations as sampled by daily egg mass collections is shown in Fig. 3. Pens 1, 2, and 10 were located on the eastern side of the release zone. This area was isolated from reinfestation on the east side by the Gulf of Mexico and partially isolated on the north side by an area of extreme drought. Pens 3, 4, 5, and 9 were in the foothills on the western side of the release zone. These areas near the mountains received 3 more rains than the eastern areas during August and September. Pen 7 also received the additional rains. During the period from August 29 to November 6, an average of 43.1 egg masses per pen was obtained from the western pens compared to an average of 9.6 egg masses per pen from the eastern pens. The percentages of sterile egg masses were 25.8 in the former group and 62.0 in the latter. Thus, comparisons made between groups of pens without regard to the local distribution of the native populations of flies are of doubtful value.

1965 Test.--Weekly distribution of egg mass collections is given in Table 1 and Fig. 4. Figure 4 also illustrates the relation of weather to egg mass collections, with the significant weather variations expressed as daily minimum temperatures, degrees centigrade. The first sharp decrease in temperature - the first norther of the winter - occurred on October 2. Another came on October 23, with cool weather thereafter until November 5. After the next norther on November 30 only 3 days of warm weather, December 16-18, occurred during the remainder of the test. Rainfall at Tuxpan during the test was 322 mm in August; 174 mm in September; October, 234 mm; November, 92 mm; December, 37 mm; and January, 54 mm. Over 96 mm fell in August between the 9th and 12th with a dry spell for a week afterwards. Over 62 mm fell between the 1st and 8th of September, with a 2-week dry spell thereafter; then the first norther came in.

Discussion

1965 Test.--The ratio of sterile to total egg masses was more constant in this test than in the first one, as shown in graph G of Fig. 4. Highest percent sterility occurred on October 2 among the south pens, when total egg masses were low (see graph E, Fig. 4). Sterility levels never approached a level necessary for eradication. Sterility achieved in the area when horsemeat-reared flies were dropped averaged slightly higher than that for the other area, but not significantly so.

Weather had a marked effect on rate of egg deposition. Heavy rains during warm weather (above 25°C daily minima) depressed the rate of egg mass deposition. Cold spells, with minima below 20°C also caused flies to stop laying. The fact that many egg masses, both fertile and sterile, were laid up to 4 weeks after a release of sterile flies, as during the period October 22

through November 26 (see Fig. 4), indicates that neither heavy rains nor brief periods of cold weather in this area kill many native flies. It suggests that the released flies also may have long lives in this environment. Persistent cold weather, with daily minima below 20°C, stops egg laying and apparently kills many flies. This was the situation after December 31, 1965 (see Fig. 4).

The most significant clue to lack of success with the 12-mile flight lanes lies in comparison of the differences among sterilities for the sets of pens located at 0-mile, 3-miles, and 6-miles from the flight lanes (see Table 1 totals). There is a definite trend toward lower sterilities with increasing distance from the flight lanes. This indicates that the chances for production of sterile egg masses in the area under the flight lanes was almost three times what it was 6 miles away. It appears that one of the following trends may have dominated other events:

1. The sterile flies did not move far from the point of release, probably no more than 4-6 miles on the average; and the native female flies, even though they may move greater distances before mating, remain to lay their eggs in the vicinity after being sterile-mated.

2. Neither native or sterile flies move about much, perhaps less than 6-8 miles on the average.

The latter possibility is the more parsimonious one.

A clear conclusion from this test is that the use of live, wounded animals in this test as attractants for oviposition is an inefficient technique for collecting data on ratios of sterile to fertile egg masses. Many more pens of animals were needed, spread over much more of the test area. Yet even at the low costs for animals and feed, and for technical personnel in Mexico, the cost per egg mass collected was about $7.00, excluding salary of the senior investigators and costs of producing and dispersing the steril flies.

Table 1.--Comparison of ratios of numbers of fertile screw-worm egg masses to all screw-worm egg masses collected in 1965 test.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T[1]	F[2]	S[3]	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
	8/13																		
8/21		13	13	0	-	-	-	6	6	0	6	6	0	13	13	0	19	19	0
	8/25																		
8/28		37	37	0	-	-	-	34	34	0	43	43	0	28	28	0	71	71	0
	9/1																		
9/4		57	57	0	-	-	-	51	51	0	73	73	0	35	35	0	108	108	0
	9/8																		
9/11		19	19	0	-	-	-	35	34	2.8	13	13	0	41	40	2.4	54	53	1.8
	9/15																		
9/18		7	7	0	-	-	-	30	30	0	7	7	0	30	30	0	37	37	0
	9/22																		
9/25		47	37	21.3	-	-	-	35	34	2.8	20	13	35.0	62	58	6.4	82	71	13.4
	9/29																		
10/2		62	52	16.1	-	-	-	40	38	5.0	21	12	42.8	81	78	3.7	102	90	11.8
	10/6																		
10/9		21	20	4.8	-	-	-	48	46	4.2	10	9	10.0	59	57	3.4	69	66	4.3
	10/13	3-mile pens fully stocked, system of wounds working as in other pens																	
10/16		24	22	8.3	29	29		38	38	0	37	35	5.4	54	54	0	91	89	2.2
	10/22	Fly drop switched to horsemeat-reared in north zone, hydroponic reared in south zone																	
10/23		11	7	36.4	23	19	17.4	36	32	11.1	31	24	22.6	39	34	12.8	70	58	17.1
	10/27																		
10/29		2	2	0	25	22	12.0	24	22	8.3	25	20	20.0	26	26	0	51	46	9.8
11/5		11	11	0	11	11	0	15	15	0	26	26	0	11	11	0	37	37	0
11/12		3	1	66.7	13	12	7.7	20	17	15.0	27	21	22.2	9	9	0	36	30	16.7
11/19		41	26	36.6	39	30	23.1	48	44	8.3	78	65	16.7	50	35	30.0	128	100	21.9
11/26	11/26	23	22	4.3	30	29	3.3	43	40	7.5	45	41	8.9	51	50	2.0	96	91	5.2
12/3		13	12	7.7	25	24	4.0	35	35	0	27	26	3.7	46	45	2.2	73	71	2.7
	12/6																		
12/10		4	3	25.0	23	19	17.4	27	23	14.8	28	25	10.7	26	20	23.1	54	45	16.7
12/17		26	22	15.4	8	8	0	20	20	0	24	21	12.5	30	29	3.3	54	50	7.4
	12/21																		
12/24		24	23	4.2	18	18	0	16	16	0	31	30	3.2	27	27	0	58	57	1.7

Table 1.--Cont'd.

Dates		6 Pens									6-9 Pens						12-18 Pens		
Collec-	Fly	(B) 0-Miles			(C) 3-Miles			(D) 6-Miles			(E) So. Zone			(F) No. Zone			(G) Both Zones		
tions	Drop	T 1/	F 2/	S 3/	T	F	S	T	F	S	T	F	S	T	F	S	T	F	S
12/31		11	11	0	12	12	0	7	7	0	11	11	0	19	19	0	30	30	00
1/7	1/6	11	11	0	7	7	0	14	14	0	15	15	0	17	17	0	32	32	0
1/14		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		467	415	11.1	263	240	8.5	622	596	4.1	598	536	10.4	754	715	5.2	1352	1251	7.5

1/ T = Total number of screw-worm egg masses collected.
2/ F = Number of fertile screw-worm egg masses collected.
3/ S = Percent sterile screw-worm egg masses collected.

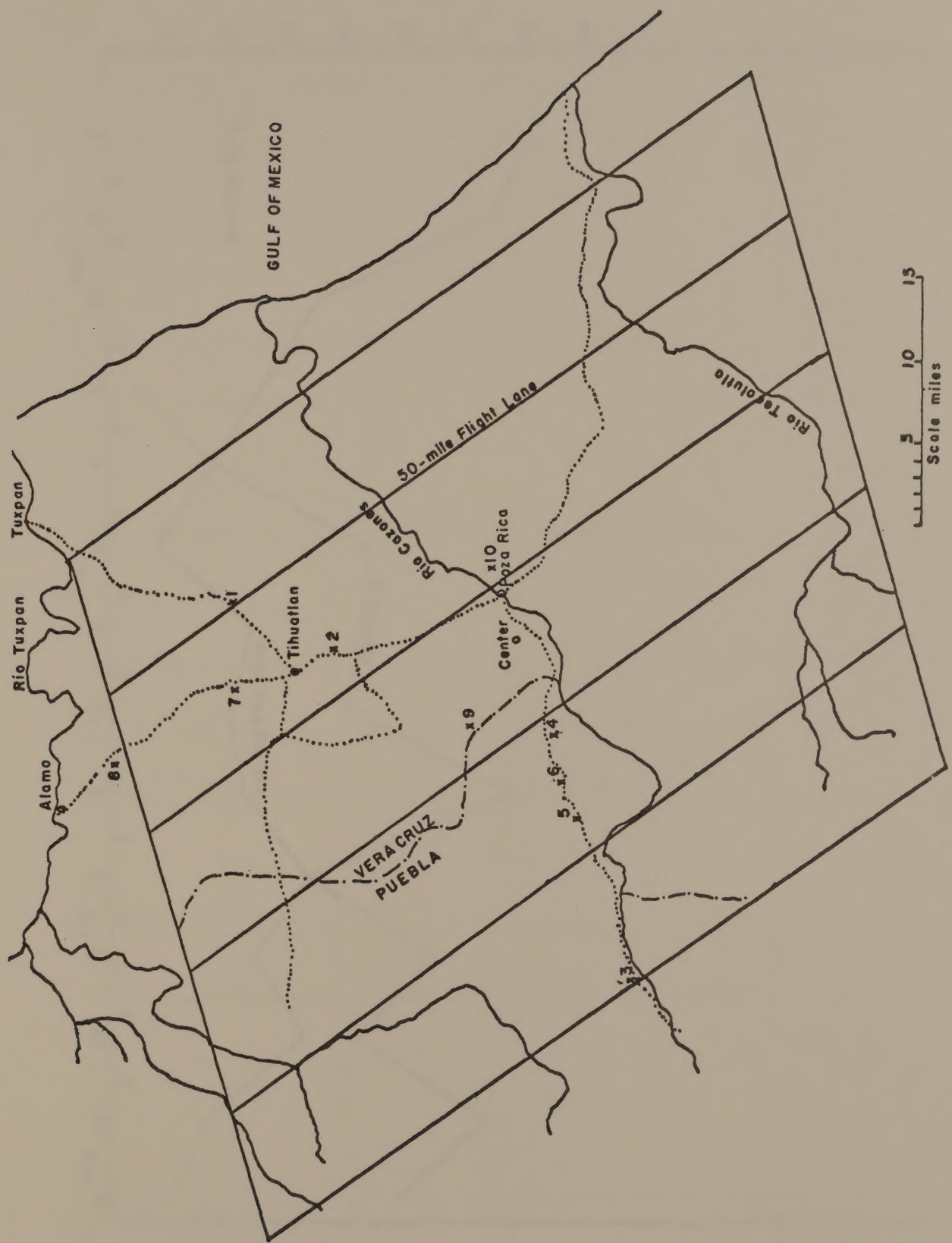

Fig. 1.--Locations of sheep pens in the 1964 experiment in northern Vera Cruz.

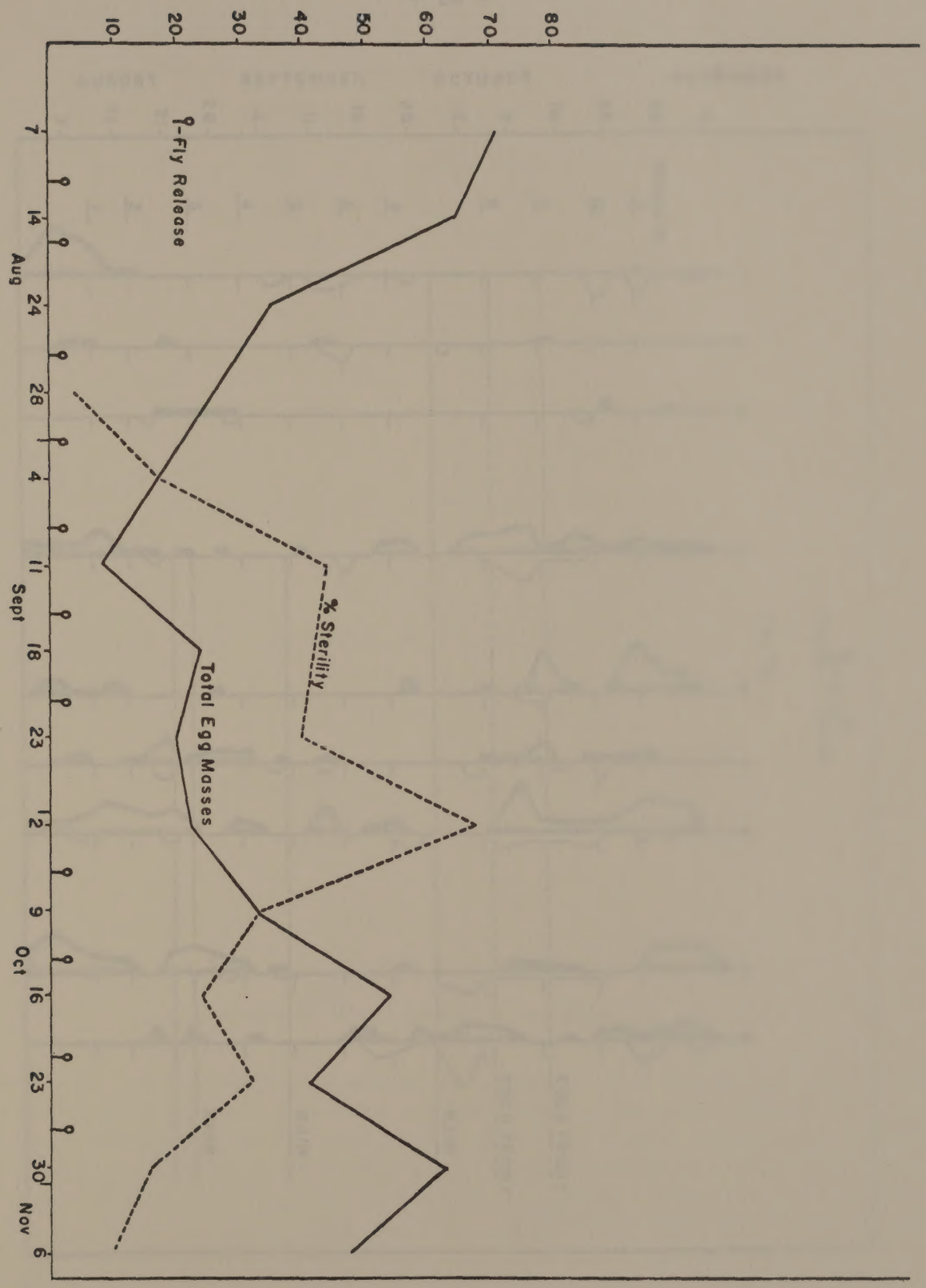

Fig. 2.--Weekly percentages of sterile screw-worm egg masses compared with total egg mass collections, Vera Cruz, 1964.

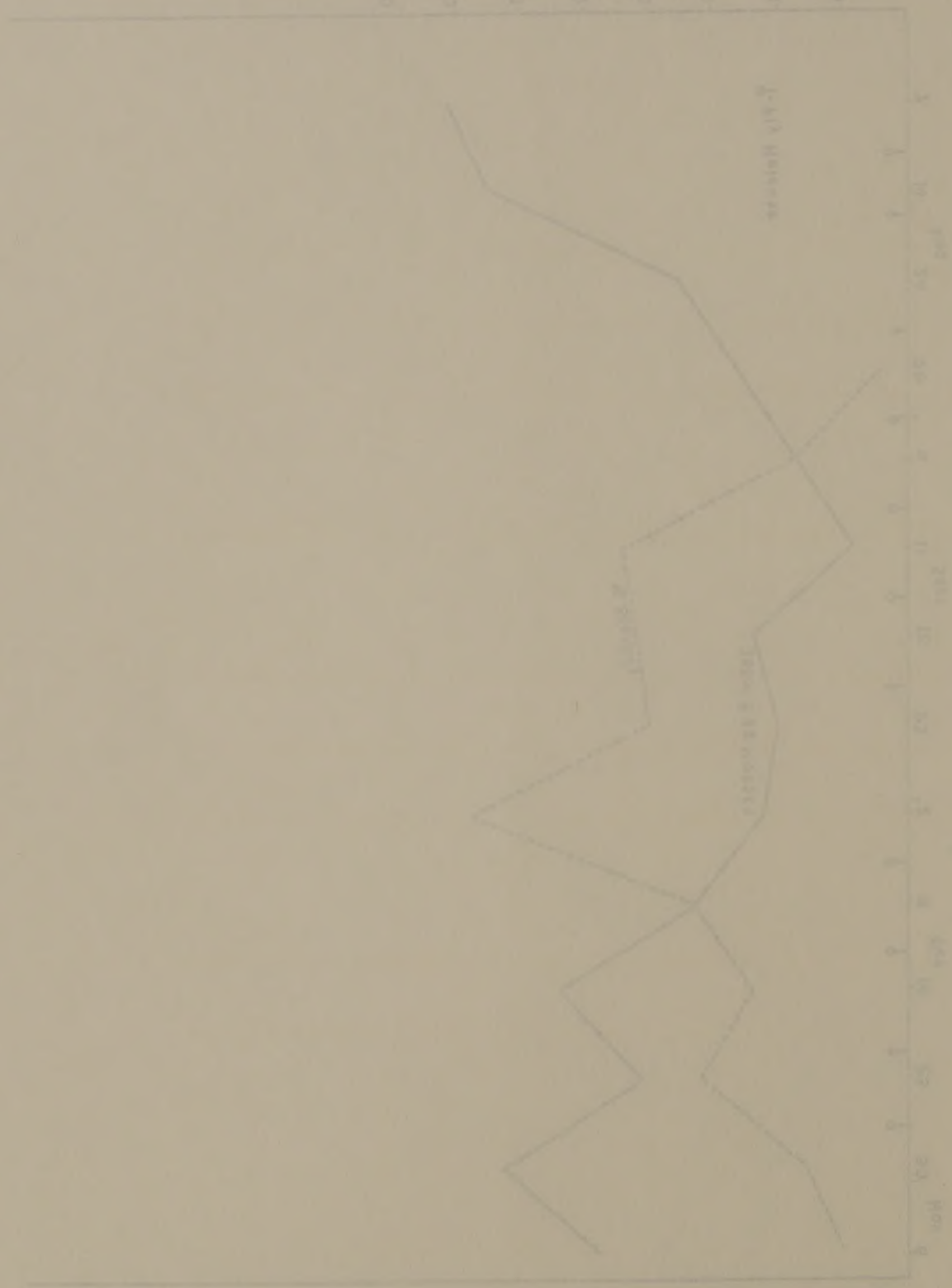

FIG. 2.—Weekly percentages of sterile screw-worm egg masses compared with total egg mass collections, Tava Cura, 1956.

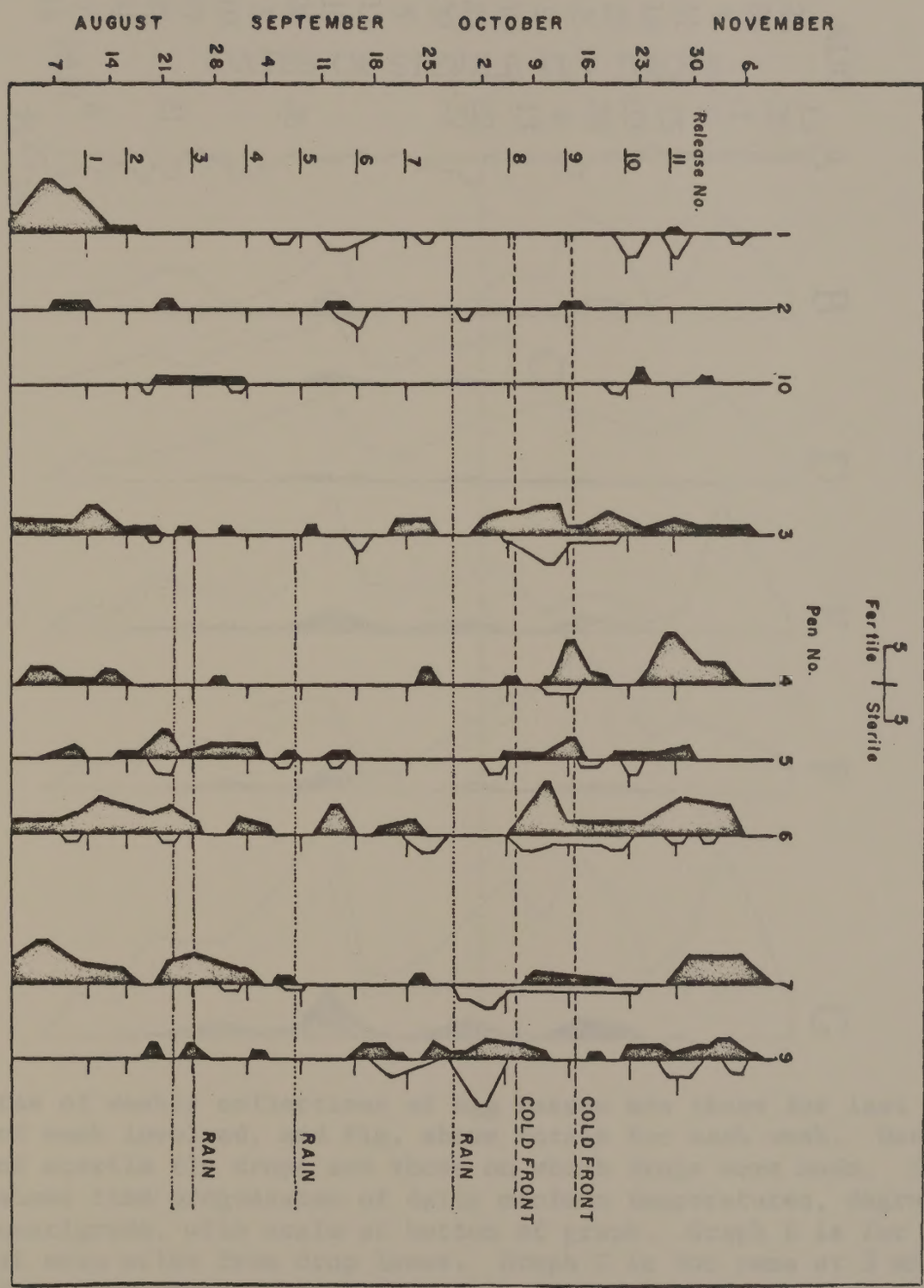

Fig. 3.--Numbers of fertile and sterile screw-worm egg masses collected from individual pens, Vera Cruz, 1964.

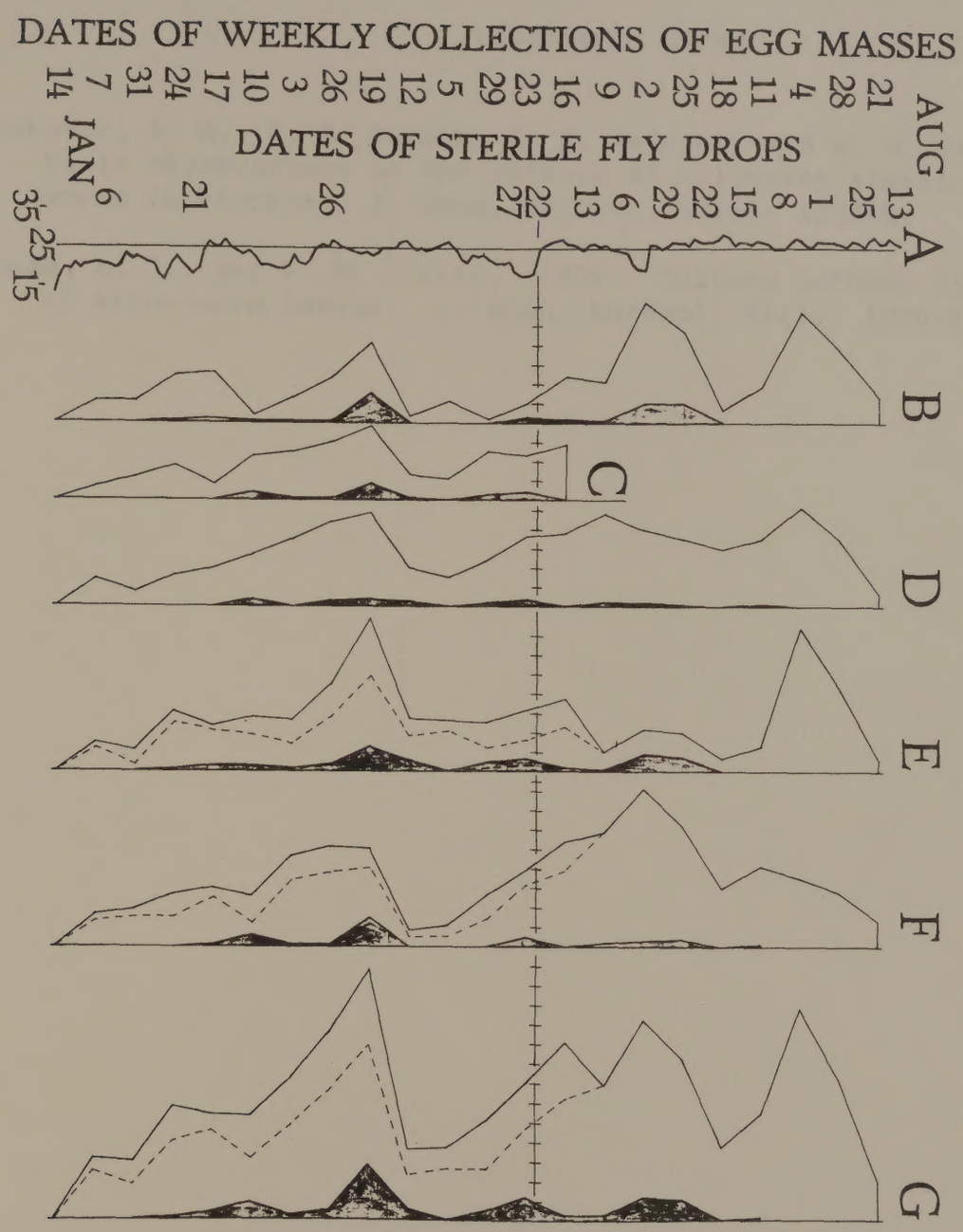

Fig. 4.--Dates of weekly collections of egg masses are those for last day of week involved, and Fig. shows totals for each week. Dates of sterile fly drops are those on which drops were made. Graph A shows time progression of daily minimum temperatures, degrees centigrade, with scale at bottom of graph. Graph B is for pens at zero miles from drop lanes. Graph C is for pens at 3 miles from drop lanes. Graph D is for pens at 6 miles from drop lanes. Graph E is for all pens in south zone. Graph F is for all pens in north zone. Graph G is for all pens together. Dotted lines in graphs E, F, and G are for pens at zero and 6 miles only. Scale for graphs B-G is shown as horizontal mid-line, each unit representing 10 egg masses.

Literature Cited

Baumhover, A. H., C. N. Husman, C. C. Skipper, and W. D. New. 1959. Field observations on the effects of releasing sterile screw-worms in Florida. J. Econ. Entomol. 52(6): 1202-6.

Graham, A. J., and F. H. Dudley. 1959. Culture methods for mass rearing of screw-worm larvae. J. Econ. Entomol. 52(5): 1096-8.

U.S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

DATE 8/16/66 ffe

TO Dr. Kingsley

AUG 16 1966

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- [ ] ACTION
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REMARKS For your info. & comments. Copy of Shannan's letter attached. However, I believe we discussed this briefly some weeks back!

Anne.

FROM I have no comments. This is ~~pretty well in line with earlier~~ discussions. It an appropriate is proposal for an expanded control program. We should submit a round proposal too. Actually this should precede a control program. Put in our next Division budget - FY 1969

GPO : 1964 OF—742-059 FORM AD-514 (8-64)

Screwworm mexico

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ENTOMOLOGY RESEARCH ~~BRANCH~~ Division
P.O. Box 986
Mission, Texas 78572

August 8, 1966

To: W. C. McDuffie, Chief
Insects Affecting Man & Animals
Research Branch
USDA, ARS, ENT
Beltsville, Md.

Through: O. H. Graham
Investigations Leader
Kerrville, Texas

From: B. G. Hightower BGH
Entomologist in Charge

Subject: Proposal for screw-worm research in Mexico

The general areas of research on the screw-worm fly needed for the support of an eradication program in Mexico were adequately covered by Dr. Sharman in his memorandum to Dr. Meyer. Obviously, some of these areas would require years of research effort.

The enclosed proposal assigns priorities to more specific research needs within the scope of these general areas.

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Entomology Research Division
P.O. Box 7336
Mission, Texas 78572

August 8, 1968

To: W. C. McDuffie, Chief
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The enclosed proposal assigns priorities to some specific research needs within the scope of these general areas.

PROPOSAL FOR SCREW-WORM RESEARCH IN MEXICO

1. Field Studies.--Ecological studies on the effects of climate, terrain, livestock populations, and husbandry practices on local populations of native flies should be conducted in as many areas in Mexico as possible. All estimates of the effectiveness of the released flies, as well as decisions on rates of production of flies, release rates, and swath widths must ultimately be made from all the available information on population dynamics. These studies would include research on the location, extent, and seasonal occurrence of "outbreak centers" of screw-worm activity.

2. Attractant Studies.--Research should be continued on evaluating candidate attractants and different types of traps with native populations of flies. These studies cannot be conducted efficiently in areas where large numbers of laboratory-reared sterile flies are being released. Ancillary studies would include the use of fertile and sterile flies in a large out-door cage to investigate the behavior of flies in response to specific compounds.

3. Biological Studies on Mexican Strains of Flies.--Additional research is needed on the techniques required for rearing, maintaining, and releasing male flies which are capable of surviving, dispersing, and mating as well as the native males. This would include mating studies with strains of flies from different areas of Mexico reared on animals compared with irradiated flies reared on various artificial media. The ultimate objective would be to reduce the cost of the medium by utilizing as many easily obtainable, low-cost materials as possible without reducing the mating effectiveness of the flies.

It is estimated that 4 professional employees and their assistants would be required. On this basis, the cost estimates would be approximately $200,000. The most advantageous location for this laboratory as far as the proximity of large populations of native flies is concerned would be near the city of Veracruz or Merida, Yucatan. However, facilities for the families of employees would probably be a problem in both these areas.

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Animal Health Division
Screwworm Eradication Activities
Vallarta 1 - 901A
México 4, D. F.

June 20, 1966

To: Dr. N. L. Meyer
Chief Staff Veterinarian
Emergency Animal Diseases
ANH, ARS, USDA, Hyattsville, Md.

From: Robert S. Sharman
Veterinarian in Charge

Subject: Screwworm Research

Part of the plan we are preparing for a joint U. S.-Mexican screwworm eradication program will deal with research needs peculiar to Mexico and which we feel would give the program a greater chance for success at less cost. Areas we think need research are as follows:

1. Continued work on an attractant. Not only would a good attractant help us tremendously in efforts to free Mexico of screwworms as far south as the Isthmus, but it would have many applications towards keeping freed zones free of the insect in the years to come.

2. Research work on rearing media that are easily available and economical in Mexico.

3. A system that can be disseminated through public media to livestock owners in Mexico that will enable them to help us keep the screwworm population at its lowest level while eradication efforts are under way. Measures being used in the United States are not necessarily suitable for use here.

4. Field studies of the native population need to be conducted that will enable us to develop a system for recognizing and effectively dealing with stubborn areas in Mexico where normal eradication techniques do not seem to be working satisfactorily.

5. Field studies, that will improve up to the last minute, our estimate of the number of flies needed each week during different seasons of the year for eradication of the pest.

6. Studies aimed at determining if there are any strains of screwworm flies that do not respond to the strains of flies now developed for laboratory use.

During the course of the survey we have discussed, informally, future research needs with research personnel on several occasions. Now that the United States has been officially declared free of screwworms, it is impossible to do any screwworm research outside of the plant in Mission, Texas. If a small research group were located in southern Mexico, they could continue screwworm research for a number of years without endangering freed areas and under circumstances where screwworms abound. The cost of research in Mexico would be less than in the States because of lower wages. Some research has already been agreed to by the Mexican Government, and there is no reason to believe they would not welcome additional work done on a cooperative basis.

Have we been doing any screwworm research in U.S. outside of Mission (Kerrville?)

We firmly believe that action should be taken as soon as possible to transfer screwworm research personnel from Mission to southern Mexico, so that we might get as much work done as soon as possible. Even though an extension of the present program does not materialize, the research outlined would still be most useful in continuing barrier activities in the present location.

If these suggestions seem appropriate, we further suggest that the matter be discussed with Entomology Research Division at the Washington level for the purpose of obtaining their views.

If, with the approval of Congress, some cooperative agreement is worked out between Mexico and the United States about adding screwworm responsibilities to the Commission, then screwworm research could be administratively supported by the Commission.

U.S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

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TO Dr. Kipling

- [ ] ACTION
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- [ ] NOTE AND FILE
- [ ] YOUR SIGNATURE

REMARKS Sorry, I forgot to attach this to Rightmire's letter re the Mexican Research proposal.

W.C.M.

FROM

GPO : 1964 OF—742-059

FORM AD-514 (8-64)

AUG 16 1966

Screwworm

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ENTOMOLOGY RESEARCH DIVISION
P. O. Box 232
KERRVILLE, TEXAS 78028

August 8, 1966

To: W. C. McDuffie, Chief, Insects Affecting Man & Animals Research Branch, USDA, ARS, ENT, Beltsville, Maryland

From: O. H. Graham, Investigations Leader
Livestock Insects Investigations

Subject: Screw-worm Research in Mexico

Dr. Hightower and I discussed your memorandum of July 19 with Dr. Sharman on July 25 and discussed the matter further at Mission last week. In the discussion with Dr. Sharman there was considerable elaboration of the six items listed in his memorandum of June 20 as to timing, locations, ANH Division plans, etc.

We feel that the research on rearing media currently being done by A. J. Graham and Dr. Gingrich can be continued at Mission and can be expanded so as to supply the information which will be needed to support the operation of a sterile fly facility in Mexico. This information can, we hope, be provided within the next 12 months and will be available before a new plant is constructed.

Research on the other five points listed by Dr. Sharman can be as sketchy or as detailed as the future situation permits. One man on the job now can probably do more for the Mexican program than five could do 3 or 4 years from now. We feel that a reasonable budget for a five year program should be based on a staff of four professional scientists and their supporting staff. Expenses can be expected to exceed the average for the United States; we recommend a budget of $50,000 per professional or a total of $200,000 net to the laboratory.

The primary consideration in choosing a location for a laboratory in Mexico is to select a place where field tests can be conducted as we can presumably continue laboratory research at Mission as long as ANH Division has a fly colony there. An important secondary consideration is living conditions for employees and their families. Only Mexico City, Guadalajara and Monterrey can provide all the facilities which American families need for long term residence and none of these are suitable for screw-worm field tests.

August 8, 1966

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The new screw-worm rearing plant is likely to be located at Tuxtla Gutierrez, Chiapas and it would definitely be advantageous for our research personnel to be located in close association with ANH Division personnel. None of us know much about Tuxtla Gutierrez but its location in the mountains causes us to suspect that the natural incidence of screw-worms in that general area is probably low. The Gulf Coast Area, Cotaxtla, Coatzacoalcos, Villa Hermosa, Yucatan, seems to be the most favorable in Mexico for screw-worm development. Of the four professional scientists at Mission, only Dr. Davis does not have school age children and would be in a position to reside with his family in southern Mexico for prolonged periods of time.

In view of the above, I recommend that we expand our field tests at Cotaxtla to the extend that the availability of personnel and funds will permit but consider this to be an interim or temporary location. At a future date, when more information about research requirements is available we will be in a better position to select a long-term location for the project.

cc: B.G. Hightower

O H Graham

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cc: B.G. Hightower

Dr. Williams E8 626

A. FIELD EVALUATION OF PROGRAM EFFECTIVENESS

1. The use of coumaphos (Co-Ral) spray has become deemphasized since the first few years of the program. This applies to Mexico, as well as the United States including Puerto Rico and the Virgin Islands.

   This important eradication tool must be reactivated (line supervision responsibility)

2. Field evaluation of spraying or dipping livestock from the standpoint of the effect on screwworms and the eradication effort.

   In heavily infested areas controlled field evaluations of spraying or dipping livestock on cooperative ranchers' herds should be conducted to determine if this spraying or dipping significantly decreases screwworm infestations in such herds. (Function)
   (This is a Mission function -- particularly Methods Development)

3. Tick eradication program in Mexico (large numbers of livestock are being dipped) and its effect on screwworm populations.

   A telegraphic request was sent to Dr. Heflin on July 6, 1972, to obtain this information.

4. More accurate estimation of native fly populations.

   There is no good practical method to accomplish this. (This is a joint problem of research, Methods Development and field forces).

5. Estimation of percent of sterile egg masses in field cases.

   A recent study was made on a cooperator's ranch in a pasture where he had recently castrated a number of calves. The cooperative rancher assigned several ranch hands to closely watch these animals and collect all possible egg masses and larvae from these wounds. This was done by the Field Operations Section. About 40 percent of egg masses were sterile (this is a Methods Development--Field Forces function). Considerable more effort is required.

6. Plans to obtain better reporting by owners.

   Reporting of screwworm and non-screwworm cases this year has been good in Texas, New Mexico, Arizona, California, and Oklahoma (particularly good). Until the last few weeks reporting has been poor in Louisiana, Arkansas, and all Southeastern States, and continues to be very poor in Puerto Rico and the U.S. Virgin Islands.

A. (Continued)

We must accelerate the information program at the Washington, D.C., and State levels. Better use needs to be made of vocational agriculture programs and the Extension Service. (This is a Staff and Line responsibility). Considerable recent improvement has been seen.

In Mexican villages "Vigilante Committees" could be organized to keep owners informed about screwworms and to report and collect specimens. This approach was very helpful in the FMO program.

7. Reporting of non-screwworm cases.

This is especially important in those States which are free of screwworm cases. By generating a more effective information program from the Washington, D.C., level and from the State level we should be able to increase the reporting of non-screwworm cases sufficiently to give us a good index of surveillance of myiasis in the various States. (Responsibility of Hyattsville Staff and Line Supervisior).

8. Written plans for pilot eradication projects in Mexico.

This has not been done, but written plans will be completed by August 31, 1972. (Hyattsville Staff--Mission function).

It is essential that such pilot projects be undertaken to tell us what problems we may encounter in certain areas in Mexico.

B. FIELD EVALUATION OF RELEASED FLIES

1. Additional fly trapping to determine how far sterile flies will fly.

Additional fly trapping is being initiated. The 1963 studies which established that a screwworm fly can fly at 180 miles. The amount of fly trapping is limited due to lack of personnel at Mission (Methods Development). If this section is strengthened by employing more personnel, fly trapping studies will be increased.

2. Field studies of quality and effectiveness of flies released.

The quality of the flies released in the field is difficult to evaluate. The best methods that we have at the present to evaluate the competiveness of the laboratory-reared sterile flies is by the use of test animals and the determination of the degree of sterility of eggs collected from these test animals. Ranch herds can also be used. (Mission--Methods Development function).

3. Attractants.

Work on attractants is a function of research. Work has been done on the study of attractants for many years without a breakthrough. The research people have recently deemphasized and practically ceased work in this field. Attempts are being made to have them reemphasize work on attractants.

4. Evaluate fly releases over Island of Vieques.

We continue to evaluate the effect of fly releases over Vieques by the use of test animals and a study by entomologists and competent technicians. This work will continue. It is being conducted jointly by personnel from the Entomology Research Division and Beltsville. We expect to drop 120,000 sterile "Puerto Rican" flies per week on Vieques starting about July 15, 1972.

The effectiveness of the Puerto Rican strain of fly will be determined by the percent of sterile egg masses collected by entomologists stationed on Vieques and by the reduction in the native fly population.

5. Study of preserved flies at USDA Attractants and Behavior Laboratory, Gainesville, Florida.

Some preserved flies have recently been sent to the Entomology Research Laboratory at Gainesville, Florida, for a study of pheromones and to scan and photograph the antennae with an electron microscope in the hope of finding and recognizing signal receptors. (Research function).

6. Work at Los Alamos Laboratories.

This is probably a long-term project which is a research function. Attempts are being made to have ENT enter into a cooperative agreement with the Los Alamos Laboratories to develop markers and study sex attractant activities.

APHIS hopes to allocate $5,000 to Los Alamos to develop a dosimeter.

7. Operation of test pens and determining percent of sterile egg masses.

We have one set of test pens in Northern Mexico. As Mission (Methods Development) is strengthened, the operation of the test pens to determine percent sterility of egg masses will be increased.

8. Mating tests between sterilized and native flies.

Additional and improved mating tests between sterilized and native flies will be conducted when personnel become available. (APHIS--Research function).

Foreign Travel Ceiling
more funds leading from Security
Med Feeding Data

C. FLY PRODUCTION

1. Take immediate steps to replace our present strain of flies with flies from at least three different strains in subcolonies.

   ENT at Mission, Texas, is working on this problem and our Methods Development Section has started a new strain in the laboratory from the aggressive Texas strain, which is responsible for the field cases in this summer's outbreak.

   Eventually each box of flies dropped can include 1/3-Florida strain, 1/3-aggressive Texas strain, and 1/3-Mission strain.

2. Continuous introduction of new genetic material into fly colony.

   Entomologists had suggested previously that new genetic material in the form of flies recently captured in the field be fed into the production colony. However, they now favor the three subcolony procedure outlined in No. 1 above.

   New genetic material will be introduced into the three subcolonies as needed. (Research--Methods Development function).

3. Maintain continuous maximum production throughout the year.

   If sufficient funds are made available, we intend to continue maximum production (200 million sterile flies per week) during the entire year. If additional funds are not available, we should reduce production at this time at a level that present funds allow. This level for the year round would be approximately 130 million sterile flies per week. Without the additional funds the longer we produce at 200 million per week, the lower the production will be for the remainder of the year. We have abandoned the practice of releasing fewer flies in the winter than we will release in the spring, summer, and fall. We do plan to release flies in the wintertime as far south in Mexico as we possibly can in order to keep screwworm flies pushed further away from this country.

4. Analyse sawdust, syrup, cotton, and boxes on a continuing basis for pesticides or other chemicals which may be harmful to flies.

   The Methods Development Section at Mission, Texas, should work with Dr. Grabbe of the research group at Mission to set up procedures to screen fly rearing materials for toxic substances.

5. Using a photoperiod similar to nature in fly rearing colony.

   We are awaiting a response from research and APHIS at Mission, Texas, on the practability of doing this. If placed in effect it could involve the installation of lights in the fly subcolonies in order to simulate daylight, darkness, as well as daily variations in temperature.

6. Feeding horsemeat at Mission.

The Hyattsville Staff will prepare a letter to Dr. Buchanan explaining the need to feed Mexican horsemeat at Mission because it is cheaper than U.S. horsemeat. We will also explain to him that VEE still exists in parts of Mexico, and we will ask him for his opinion as to whether it is safe for our employees at Mission to handle Mexican horsemeat in the fly rearing process. Additionally, Lt. Colonel Spertzel has been contacted and he states that if enzyme action on the horsemeat creates a ph of 6 or below the virus is inactivated within 15 minutes. Tests are now being conducted to see if this ph is reached.

We note that horsemeat can presently be imported from Mexico and shipped to approved establishments where it is handled by plant personnel.

D. FLY HANDLING

1. Feeding or not feeding flies in cartons.

It was recommended that we do not feed the flies in the cartons. However, the Methods Development Section at Mission has conducted some tests and found that when the flies are not feed there is excessive mortality. These tests will be repeated.

2. Reduce the loading rate of flies in boxes.

It is agreed that it would probably be beneficial to reduce the loading rate of the flies in the boxes from 2,200 to 1,550. This would provide a more even distribution of flies, but costs would increase. We are awaiting a recommendation from Mission on the practicability of this procedure.

3. Chill or not to chill.

Formally, flies were held at 45° F. for 4½ hours prior to release. Following a recommendation this practice has been stopped and pupae are now being held at 80° F. until 90 percent of the flies have emerged. If it becomes necessary to chill flies before their release, we will not lower their temperature below 65° F.

E. QUALITY CONTROL

The Staffs at Hyattsville and Mission will review the quality control procedures. At the present time we think quality control procedures are adequate.

F. FLY DISPERSAL

1. Reduce screwworm swath widths from 10 miles to 5 miles.

Lack of funds and insufficient number of pilots, has not permitted reduction of swath widths from 10 miles to 5 miles.

2. Cost evaluation of different air delivery patterns and schedules for dispersal of flies.

This involves the following possibilities:

a. Deliver flies once a week using a 10 mile swath width
b. " " twice " " " " " " " "
c. " " once " " " " 5 " " "
d. " " twice " " " " 5 " " "
e. " " " " " " " 10 " " "
(on second delivery drop halfway between the previous 10-mile line).

We are awaiting cost accounting figures from Mission.

F. (Continued)

3. Design and "carry out" field trapping procedures which will produce results acceptable to user group. (Data to be used to evaluate best dispersal patterns and frequency).

The research group and the Methods Development Section should continue testing for the best dispersal pattern and frequency of fly release.

4. Investigate air-conditioning aircraft.

Mission will upgrade the air-conditioning equipment which is used while loading the flies. They will continue to see that the planes take off immediately after loading and fly at an altitude sufficiently cool to preserve the flies. Mission will also explore the possibilities of air-conditioning fly release aircraft. The cost to air-condition the old aircraft may be prohibitive. They will advise us on estimated costs.

5. Renew studies on free release of flies.

These studies have been conducted on a small scale for several years. There are many problems connected with the free release of sterile screwworm flies. Although Plant Protection has been able to free release some of their insects, the same techniques are not necessarily conducive to the release of the sterile screwworm fly. Mission will continue to study the free release. A meeting will be set up in the very near future with the Plant Protection people and Mr. G. G. Rohwer to discuss this matter.

G. PERSONNEL NEEDS

1. Personnel needed for Methods Development and a plan for the augmentation of this activity.

COSTS - ADDITIONAL EMPLOYEES

1 Entomologist (GS-11)	13,309
3 Bio-technicians (GS-5)	21,957
1 Bio-technician (GS-9)	11,782
1 Insect Reser. Hlpr (WB-5)	6,955
10 Insect. Reser. Hlprs (WB-4)	65,483
TOTAL	$ 119,486

2. General personnel needs:

Mission--We need at least 3 more pilots in order to go to the 5-mile swath width.
1 draftsman

Mexico--During FY 1973 there will probably be 5-7 man years needed to augment the initiation of the Mexican program.

G. (Continued)

3. Greatly intensify methods development work at Mission, Texas.

If #1 is fulfilled, the Methods Development Section work at Mission, Texas, will be intensified.

H. MAINTENANCE OF FACILITIES AND EQUIPMENT

Construction of irradiator designed by Mr. Husman.

The construction of the prototype irradiator is progressing satisfactorily and will be completed during FY 1973. Plans are now in hands of AEC. We will conduct the USDA Radiological Safety Officer (Mr. Howard Roberts) and push plan along. Upon completion of the irradiator it will be shipped to Mission and thoroughly tested at that location.

I. SHIP CONSTRUCTION

Ship construction projected schedule.

Plans for ship modification have been made. As soon as funds are made available and the contract is let we will prepare a schedule for a projected completion date.

J. MEXICO SCREWWORM ERADICATION PROGRAM

1. Signing of Mexico-U.S. Agreement.

This agreement will be signed as soon as officials of both Governments agree to a time and place. (Deputy Administrators function)

2. Environmental Impact Statement in respect to U.S.-Mexico Program.

The statement we prepared was not considered acceptable and Hyattsville Staff will prepare another.

K. INTERSTATE REGULATIONS

1. Interstate screwworm regulations.

These regulations are in the Office of The General Counsel being processed.

2. Roving inspectors to check shipments for compliance.

Veterinary Service Regional Directors and the Veterinarians-in-Charge should assign roving inspectors as available and necessary to check shipments for compliance.

L. PESTICIDES PERMITTED FOR USE AGAINST SCREWWORMS

1. Evaluate effectiveness of pesticides presently labeled for use against screwworms.

For many years the ENT personnel have evaluated the effectiveness of various pesticides against screwworms. Many of these pesticides have been withdrawn from use or further restricted by the Environmental Protection Agency. ENT will continue to evaluate these pesticides and our Methods Development Section can cooperate when their services are needed.

Hyattsville Staff will review all pesticides labeled for use against screwworms and evaluate efficiency data.

2. Obtain label for 5 percent coumaphos (Co-Ral) in 5-gram packets for distribution in Puerto Rico and the United States.

The Hyattsville Staff will accelerate efforts to obtain a label for this product and attempt to find a packaging company to package the product. Efforts so far have not been very productive.

M. ADMINISTRATIVE

1. Contingency fund for screwworm activities to be used during this period as in 1972 and 1968.

Dr. Knipling recommended that we have a $1 million contingency fund for screwworms. A memorandum--subject: Justification for an Increase in the APHIS Contingency Fund, June 5, 1972 to Dr. Saulmon from Dr. Miller--includes the request of the screwworm program for a contingency fund.

2. Revise contingency plan per Dr. Wise's wishes.

A flexible contingency plan was prepared on June 7, 1972, but was rejected. This plan is in the process of being revised.

3. Fly release plan.

Enclosed is a fly release plan prepared by Dr. Meadows with which we concur.

4. Thin film release.

This is an excellent method to release flies when screwworm infestations are at a low level, and we will continue to use it under these conditions. Under the present explosive outbreak conditions, we find it to be not effective. We recommend that the thin-film release be conducted along the eastern Texas region.

M. (Continued)

5. Have methods development group at Mission report directly to Hyattsville.

   We believe that this unit will not operate successfully under long-range supervision from Hyattsville, and that it should remain under Dr. Meadow's close supervision.

6. Evaluation of present location of barrier zone area.

   The barrier zone has been sufficiently wide so that except for 2 years, 1968 and 1972, there have been no problems of many cases of myiasis north of the barrier zone. In view of the initiation of the Mexican program and in light of the past years, we see no reason at this time to increase the area encompassed by the barrier zone.

7. Matching funds (provided by States).

   The States, particularly Texas, and the SWAHRF, have provided funds that more than matched all infestations north of the barrier zone during all of the years since eradication was declared, except for 1968 and 1972. We believe that provisions could be made that could combine their over-matching through the years to take care of the under-matching during this fiscal year.

SCREWWORM ERADICATION PROGRAM
Mission, Texas

Summary of Minutes of Field Operations Technical Meeting

Distribution Center, Douglas, Arizona
October 4-5, 1966

Present:

Dr. M. E. Meadows, Jr., Veterinarian in Charge of Field Operations, ANH, Mission, Texas
Dr. D. L. Williams, Chief Staff Veterinarian for Screwworm Eradication, ANH, Hyattsville, Maryland
Dr. R. S. Sharman, Veterinarian in Charge of Screwworm Activities, ANH, Mexico, D. F., Mexico
Dr. R. L. Pyles, Veterinarian in Charge, ANH, Albuquerque, N. M.
Dr. John Tweed, Acting Veterinarian in Charge, ANH, Phoenix, Ariz.
Dr. Martin Kagan, Assistant Veterinarian in Charge, ANH, Albuquerque, New Mexico
Mr. A. H. Baumhover, Investigations Leader, ENT, Oxford, N. Car.
Mr. John Hays, Chairman, Arizona Screwworm Committee, Yarnell, Ariz.
Dr. B. G. Hightower, Entomologist in Charge of ENT, Mission, Texas
Dr. F. E. Smith, Epidemiologist in Charge, Douglas Distribution Center, ANH, Douglas, Arizona
Dr. L. E. Moffit, Epidemiologist in Charge, Mission Distribution Center, ANH, Mission, Texas
Dr. W. L. Tarver, Supervisory Veterinarian, ANH, Monterrey, N. L., Mexico
Dr. R. R. Lindley, Area Veterinarian, ANH, Douglas, Arizona
Dr. Pedro Elizalde, Port Veterinarian, Agua Prieta, Sonora, Mexico
Dr. Coronel, Meat Inspection, Agua Prieta, Sonora, Mexico
Mr. Thomas Fisher, Supervisory Livestock Inspector, ANH, Mexico, D. F., Mexico
Mr. W. A. Farnsworth, Livestock Inspector, Nuevo Casas Grandes, Chihuahua, Mexico
Mr. George Mudd, Livestock Inspector, Hermosillo, Sonora, Mexico
Mr. Oscar Pasillas Villa, Livestock Inspector, Mexican Government, Casas Grandes, Chihuahua, Mexico
Mr. A. J. Graham, Entomologist in Charge of Methods Development, ANH, Mission, Texas
Mr. [illegible] R. Nichols, Entomologist, Methods Development, ANH, Mission, Tex.
Mr. J. J. Hoover, Flight Coordinator, ANH, Mission, Texas
Mr. C. R. Greinke, Pilot, ANH, Mission, Texas
Mr. Arden McFadden, Livestock Inspector, Silver City, New Mexico
Mr. Raymond Evans, Supervisory Livestock Inspector, Phoenix, Ariz.
Mr. Bill Beasley, Livestock Inspector, Phoenix, Arizona
Mr. A. N. Lamb, Livestock Inspector, Douglas, Arizona
Mr. John Cloudt, Livestock Inspector (retired), Douglas, Arizona

Dr. Meadows opened the meeting by describing the total release and total cases during the past three years in Sonora, Chihuahua and Arizona, pointing out that although we have increased our sterile fly release each year in Sonora, we have been unable to decrease the total infestations:

As of September 30, 1966	1964	1965	1966
Sonora			
Screwworm Cases	2,115	2,210	2,321
Flies Released	321,968,400	1,219,973,200	1,053,114,400
Chihuahua			
Screwworm Cases	1,413	987	987
Flies Released	342,246,250	405,599,600	180,789,600
Arizona			
Screwworm Cases	158	465	267
Flies Released	163,718,000*	403,044,800	535,160,000

*First Flies Dropped in May

The purpose of this meeting is to attempt to develop plans that will accomplish control in Sonora in spite of the handicaps that may occur.

Dr. Sharman and Dr. Tarver reviewed the field inspection force fluctuations that have occurred since the barrier began. From a high of 8 U. S. inspectors and 16 Mexican inspectors along the entire barrier, the force was reduced at one point to 8 U. S. and 6 Mexican inspectors. At the present time there are 8 U. S. and 12 Mexican inspectors.

In Sonora the force has ranged from a high of 2 U. S. and 4 Mexican inspectors to a low of one U. S. and two Mexican inspectors. One of the U. S. inspectors not only works in Sonora, but is also responsible for the northwest sector of Chihuahua. At the present time there are 2 U. S. and 3 Mexican inspectors working Sonora. Dr. Sharman stated each inspector is responsible for approximately 40,000 square miles of territory.

Mr. Farnsworth briefly described a survey just completed. In this survey from five to ten ranchers in each Municipio were asked the following questions:

1. What percent reduction in cases occurred in 1964 after sterile fly treatment began as compared to pre-treatment years? In 1965? In 1966?

2. In which year did you feel that there were more infestations, 1964, 1965 or 1966?

3. In which year did you feel that there were less infestations, 1964, 1965 or 1966?

(For results of this survey, see Attachment A.)

Dr. Tarver reviewed the infestation situation during the past winter. Early this spring the area north of a line through Hermosillo was free except for a small area between Ures and Baviacora. Due to extremely favorable weather conditions making desert grazing desirable and a favorable market in the United States, mass movement of cattle occurred from infested areas in southern Sonora and Baja California Sur to grazing areas and importation points in northern Sonora and Baja California Norte. Large numbers of these animals were freshly wounded (man-made) before moving. Due to this movement, plus naturally favorable conditions for migration, we quickly lost our advantage. Infestations were widely scattered throughout Sonora with the result that there are more infestations present now than before.

Dr. Meadows outlined the beginning of the barrier in Sonora and Chihuahua. During the winter of 1963, five river valley releases were instituted in Sonora (Map A). In addition, in May, 1964, a barrier was established in Arizona to protect New Mexico as Arizona was not in the program.

Dr. Smith then described the pattern of treatment from October, 1964, to the present. The patterns with descriptions are attached as Maps B, C, D, E, F, G and H.

GENERAL DISCUSSION:

Dr. Meadows requested the Entomology representatives give their reasons why infestations may continue to occur even in areas of fairly heavy sterile fly release.

Dr. Hightower explained that field tests using marked flies had revealed migration up to 180 miles (the extent of the test traps). Sterile males would have no effect if the female was bred prior to entering the area. In addition, in mountainous terrain effectiveness in treating deep valleys and canyons from higher altitudes is unknown.

Dr. Smith suggested that calculation of flies per square mile surface area in level terrain can be quite different in mountainous terrain where surface area is greatly increased. Another factor is the time lag between collection of larval sample and time of treatment.

Mr. Baumhover explained that during favorable periods, fly mating can occur within 10 to 11 days after a sample is taken if some mature larvae escape from the wound.

Dr. Tarver explained the "quadrant coordinate system" and the "critical line" now used as an attempt to reduce the present time lag in Sonora and Chihuahua. Considerable discussion of the problems present resulted in the opinion that primary consideration should be given to:

1. Number of sterile flies necessary for Sonora control.
2. Terrain with accompanying problems:
   (a) Valley treatment.
   (b) Inspection in the mountains.
   (c) Flies per square mile.
   (d) Ability to utilize aircraft effectively.
3. Migration of flies.
4. Hauling flies from Mission to centers.
5. Climatological factors.
6. Number of properly located centers.
7. Surveillance.
8. Livestock movement and populations.
9. Lag time.
10. Rancher cooperation.

Mr. Greinke described the mountainous terrain of eastern Sonora and western Chihuahua and identified the problems encountered in flying this terrain; such as, no prior weather information, updrafts, downdrafts, turbulence, etc. Although the problems mentioned are not of a continuous nature, extended periods of unfavorable climatic conditions could seriously deter effective treatment.

Dr. Meadows explained the cost factor involved in flying deadhead to reach dispersal areas long distances from distribution points.

After conferring, the group suggested the establishment of two distribution centers in Mexico for the following reasons:

1. Due to the distance from the Douglas Center to the primary area of treatment, considerable deadhead time will be eliminated by having the centers in the area.

2. By originating flights in the area, weather conditions will be known before the flight begins, thereby decreasing lost flight time and increasing safety factors.

3. Flexibility of treatment, particularly as to the time of day, is greatly increased when origin of flight is close to the treatment area.

The suggested center sites were Chihuahua City for six months of the year and Cuidad Obregon for twelve months of the year.

Dr. Meadows was concerned with the release of sterile flies in the mountainous areas of eastern Sonora and western Chihuahua that contain canyons or valleys with temperatures permitting overwintering. Some of these valleys supposedly have orange and banana trees growing there twelve months of the year; yet, because of the surrounding terrain, release must be accomplished from altitudes of a minimum of 8,000 feet to a range of 10,000 to 12,000 feet with outside subfreezing temperatures which at certain times of the year would be at or near zero.

Mr. Graham stated altitude tests comparing release from 10,000 feet with release from 1,500 feet were made early in the program, and that no harmful effects were noted from the high altitudes. We do know, however, that certain temperatures have a deleterious effect on flies and for this reason, our fly release operations have always been adjusted both as to time of release and altitude with the seasons of the year to insure maximum fly effectiveness in the field, Dr. Meadows said. It was stated that if more flies could be released early in the morning when there is less turbulence and the air is relatively calm, the flies would probably stand a better chance of getting into the canyons even if the same release altitude is used. This type of adjustment would only be possible if there was a distribution center in the area, but the outside release temperature would still be a factor, particularly during the winter.

Since there is a lot of this type terrain in Mexico, Dr. Meadows felt very strongly that if we are ever to have an eradication program in Mexico, we must determine conclusively: (1) whether flies released at high elevations in subfreezing temperatures will reach the temperate areas of the valleys and canyons, (2) their effectiveness upon reaching these areas, and (3) the level of sterile fly release necessary to achieve results in mountainous terrain. This was discussed extensively, with the group unanimously agreeing that research should be conducted to get answers to these questions.

Infestation reporting from the ranches, especially in those areas where travel is severely handicapped, was reviewed extensively. Many suggestions were offered including extensive information campaigns such as direct mail contact to the cowboys, radio and newspaper bulletins, increased inspector contacts, etc. Dr. Tarver outlined a plan whereby the inspectors would make use of the Sonora Cattlemen's Association radio system in the difficult terrain areas of Sonora to supply rapid information of infestations. As there is a direct relationship between inspector visits and rancher cooperation not only in reporting but also in preventive measures on the ranches; the group suggested the addition of at least five additional inspectors to Sonora. Increased inspectors should stimulate improved movement controls and husbandry practices for the benefit of the program.

Dr. Sharman reported that as a result of the extensive cattle movement this spring, a meeting with Mexican officials in Sonora has resulted in the following regulation: No animals will be moved that are infested or wounded. All animals south of the tick line will be inspected before moving north. If infested or wounded, they will be turned back. Dr. Lindley stated that last spring entire herds presented for importation and containing freshly wounded and/or infested animals were refused. Baja California has adopted the same regulation and Chihuahua is in the process of adopting the regulation.

In examining methods of moving sterile flies from the plant to distribution centers, the question of possible damage from long hauls in trucks was discussed. Mr. Graham reported quality control checks showed no significant difference in the flies hauled long distances and those released at Mission.

Dr. Donald Williams felt that even though there were no significant differences noted in quality control checks, it was very possible that flies subjected to the stress from such movement could have sustained hidden damage which upon release would affect their liveability and performance in the field. For this reason, he felt longevity tests should be conducted on flies trucked to Douglas and compared with flies released from Mission.

Also discussed was the method of supplying flies to distribution centers in Mexico if established. The recommendation was that where possible, flies should be trucked as they are now to Douglas. If trucking is not practical, then the pupae should be flown and packaging done at the center.

From the results of this spring, it is apparent the fly migration from the population existing in southern Sonora and Chihuahua the year around is an important factor in the buildup occurring in northern Sonora in the spring. In order to control infestations within the area of Sonora

and Chihuahua just south of the United States, the group opinion was that increased sterile fly release be made during the winter months down to the 26th degree and east into Chihuahua as far as investigations show overwintering is occurring. In conjunction with treatment in the south, elimination of overwintering areas farther north will be necessary. It is estimated and suggested at this time that from sixty to eighty million sterile flies per week be made available for this work. This allocation of flies was not predicated on a decrease in flies for the eastern barrier zone but on 45-50% of fly production.

Considerable time was spent on the lag time between larval collection and sterile fly release in Mexico. The entire process was broken down into stages; i.e., from ranch to post office, post office to identification center; identification center to livestock inspector in the field; coordinates from livestock inspector to the distribution center; and from the distribution center to the ranch. Dr. Sharman outlined in detail the various phases and the steps taken to improve each. Although the problem was thoroughly discussed, the only group suggestion was to increase the inspection force and public relations activities in order to improve rancher cooperation.

If lag time for the submission of samples is not reduced by the use of more inspectors and increased public relations activities, the question was raised whether an area with a previous history of heavy outbreaks following rains should be treated before confirmed samples indicate a buildup. The proposal was made to use climatological and weather data in such instances, as well as observation on relative densities of livestock populations and husbandry practices, as an additional guide in allocating flies.

In summary, the specific recommendations of this group were:

1. Extend winter release in Sonora and Chihuahua south to the 26th degree and eastward as far as surveys show overwintering is occurring. Allow sixty to eighty million sterile flies per week for this purpose on the basis of 45-50% of fly production.

2. Increase present Sonora inspection force by a minimum of five additional inspectors.

3. Institute research on the effectiveness of treating deep canyons and valleys in eastern Sonora and western Chihuahua.

4. Establish two distribution centers in Mexico--one at Chihuahua City, Chihuahua, to operate approximately six months of the year, and one at Cuidad Obregon, Sonora, to operate constantly.

5. Conduct longevity tests on flies hauled long distances by truck.

6. Increase public relations with Mexican ranchers and cowboys in an attempt to improve reporting and decrease "lag time."

7. Establish criteria for priorities of fly releases by specific areas, if lag time not sufficiently reduced by use of more inspectors and increased public relations activities, based on epidemiology study by the Distribution Center Epidemiologist.

ATTACHMENT A

PERCENTAGE OF CASE REDUCTION*

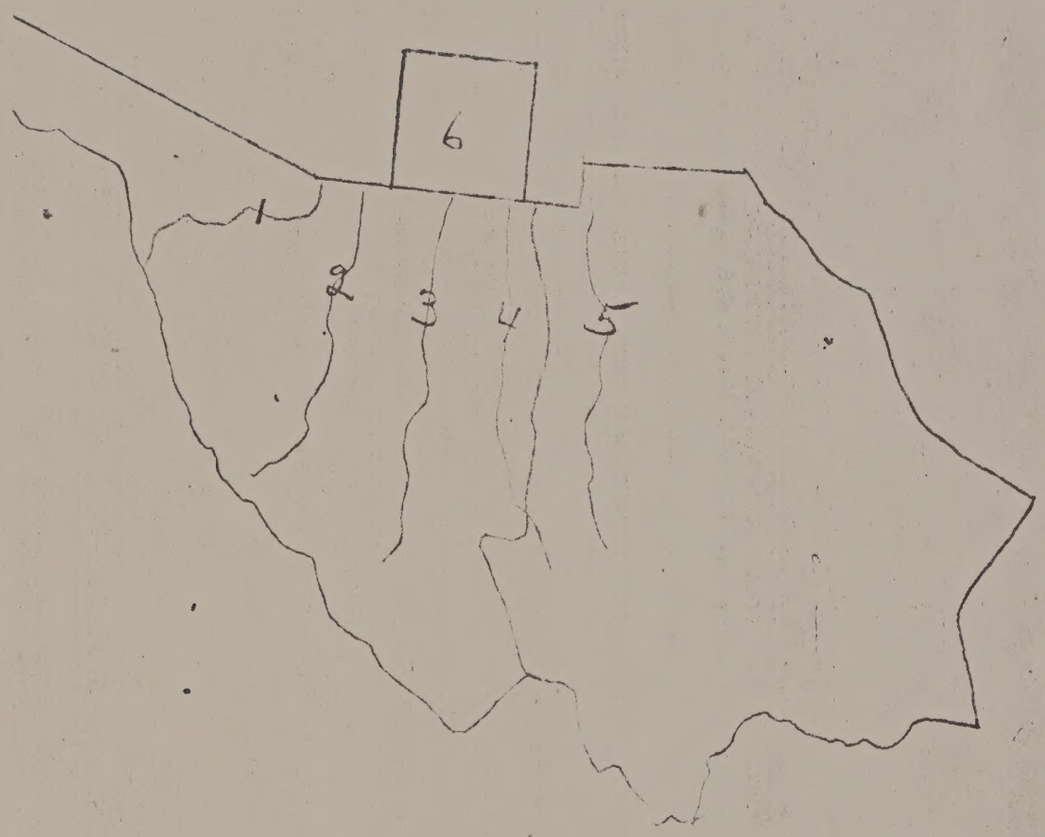
Year-Round Drop Area	%-1964	%-1965	%-1966
Agua Prieta	65.8	80.6	76.3
Bavispe	71.0	92.6	81.1
Bacerac	67.2	86.6	70.5
Huachinera	61.2	91.5	68.0
Nacori Chico	69.7	92.1	69.5
Bacadehuachi	65.0	91.0	75.0
Huasabas	67.5	94.5	85.7
Granados	60.5	94.6	86.0
Oputo	68.7	93.5	92.2
Nacozari	55.5	90.7	87.5
Fronteras	60.0	90.0	93.0
Soyopa	54.4	93.5	59.5
Sahuaripa	77.8	85.4	70.0
Arivechi	44.0	63.0	50.5
Average	(63.5)	(88.5)	(76.1)
Partial-Treatment Area			
Bacanora	62.3	86.4	75.9
Rosario	57.5	69.8	59.0
Quiriego	27.6	47.0	43.0
Navajoa	30.0	50.0	56.6
Alamos	40.1	55.0	23.0
Yecora	2.5	95.0	0
Average	(60.2)	(52.2)	(51.5)
Overall Average	56.4	77.6	66.1

110 reported that there was more infestation in 1964; 35 reported more in 1966.

108 reported less infestation in 1965; 23 reported less in 1966; 14 reported less in 1964.

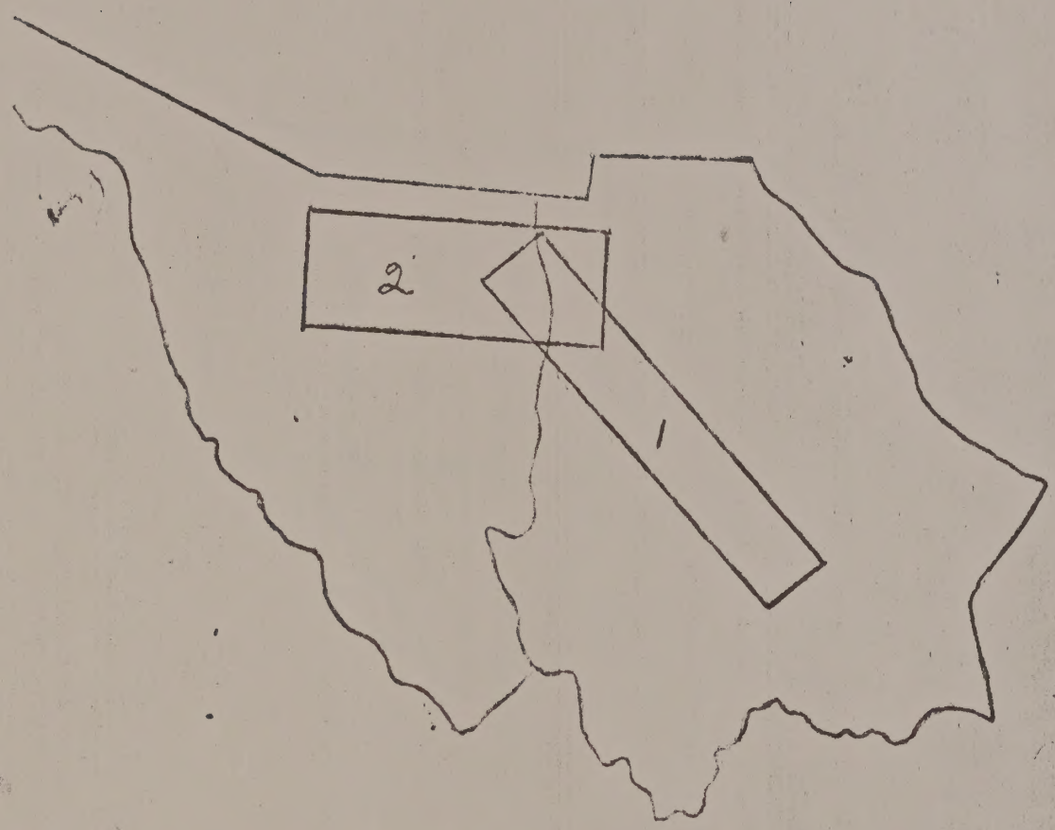
*Since the program was started.

MAP A



1. Rio Magdelena
2. Rio Sonora
3. Rio Nacozari
4. Rio Bavispe
5. Rio Casas Grandes
6. Arizona Barrier

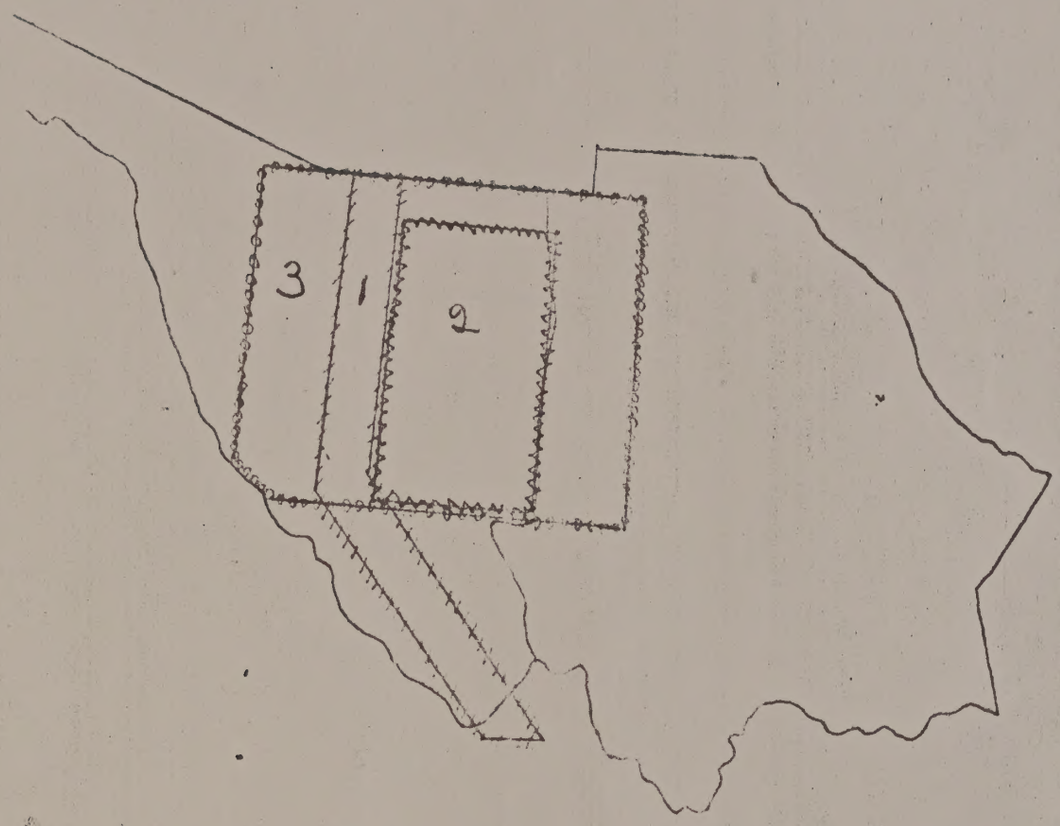
MAP B



October 1, 1964 to December 13, 1964
Avg Total Weekly Release in Sonora-Chihuahua 19,400,000

1. 4-mile lane; 500 flies per square mile. (Ended November 13, 1964)
2. 4-mile lane; 500 flies per square mile.

MAP C



January 1, 1965 to July 6, 1965
Avg Total Weekly Release in Sonora-Chihuahua 31,700,000

1. Started January 15. 4-mile lanes; 750 flies per square mile.
2. Started April 1. 4-mile lanes; 1,000 flies per square mile.
3. Started April 16. 8-mile lanes; 500 flies per square mile.

MAP D

July 7 to October 18, 1965
Avg Total Weekly Release in Sonora-Chihuahua 35,000,000

1. 4-mile lanes; 1,000 flies per square mile.
2. 8-mile lanes; 500 flies per square mile.

MAP E

October 18 to December 31, 1965
Avg Total Weekly Release in Sonora-Chihuahua 23,300,000

1. 8-mile lanes; 500 flies per square mile.
2. 4-mile lanes; 1,000 flies per square mile.
3. 4-mile lanes; 1,000 flies per square mile.

MAP F

January 1 to March 15, 1966
Avg Total Weekly R lease in Sonora-Chihuahua 32,000,000

1. Strategic release.
2. 4-mile lanes; 400 flies per square mile.

MAP H

May 16 to date
Avg Total Weekly Release in Sonora-Chihuahua 28,000,000

1. 4-mile lanes; 500 flies per square mile.
2. 8-mile lanes; 1,000 flies per square mile.

Screw-Worm Erad.-Gen.

NOV 23 1966

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
ANIMAL HEALTH DIVISION
SCREWWORM ERADICATION PROGRAM
POST OFFICE BOX 696
MISSION, TEXAS 78572

November 22, 1966

To: Dr. O. H. Graham
Investigations Leader
Livestock Insects Investigations
ENT, Kerrville

From: S. C. Gartman
Assistant Veterinarian in Charge
of Screwworm Eradication Activities
ANH, Mission

Subject: Screwworm survival and mating activity in Sonora

We have your memorandum of November 21 concerning the above subject.

We have requested the Division to take formal action as to negotiation at the Hyattsville level asking Entomology Research Division to perform such research.

As far as helping with the test animals, this would have to come from the Division level to Dr. Sharman for any definitive action.

AS FORM 114 (12-61)
UNITED STATES GOVERNMENT

Memorandum

U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Entomology Research Division
Kerrville, Texas

SUBJECT: Screw-worm survival and mating activity in Sonora

TO: W. C. McDuffie, Chief
Insects Affecting Man and
Animals Research Branch
Beltsville, Maryland

DATE: November 26, 1966

Insects Affecting
Man & Animals
NOV 28 1966
W. C. M.
D. E. W.
J. A. F.

Enclosed for your information is a Thermo-Fax copy of Dr. Gartman's reply to my memorandum of November 21 on this same subject.

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosure

cc:
B. G. Hightower

AS FORM 114 (12-61)

UNITED STATES GOVERNMENT

Memorandum

U. S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Entomology Research Division
Kerrville, Texas

SUBJECT: Survival and movement of sterile screw-worm flies in deep mountain valleys in Sonora, Mexico

TO: W. C. McDuffie, Chief
Insects Affecting Man and Animals Research Branch
Beltsville, Maryland

DATE: November 25, 1966

In accordance with my request, Dr. Hightower has prepared a proposal for a research project in Sonora which would supply information needed by ANH Division. You will remember that ANH Division has informally requested ENT to undertake a study of this type. Their request is the direct result of problems they have encountered in dispersing sterile flies in Sonora; it appears that significant numbers of native screw-worms have persisted in certain regions despite drops of sterile flies which should have overwhelmed them. Some of us believe that the eradication of screw-worms from the rest of Mexico will be comparatively easy after they have been eliminated from northwestern Mexico (Chihuahua, Sonora, and northern Sinaloa).

The proposed project is well justified technically as well as by the ANH Division request. Our only problem is deciding whether or not other research should be stopped so as to shift either Dr. Hightower or Dr. Davis and supporting funds from their present assignment to the Sonora study. Of the $45,000 available for operation of the Kerrville and Mission laboratories for the last eight months of FY 67, almost one-fourth would have to be used for this one project.

We would appreciate any guidance you can give us concerning the priority this proposal should be given.

O H Graham

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosure:
Proposal for Field Test in Sonora, Mexico

cc:
B. G. Hightower

Entomology Research Division
Kerrville, Texas

Survival and movement of sterile screw-worm flies in deep mountain valleys in Sonora, Mexico

W. G. McGuffie, Chief
Insects Affecting Man and
Animals Research Branch
Beltsville, Maryland

Dear Mr. McGuffie:

In accordance with my request, Mr. Hightower has prepared a proposal for a research project in Sonora which will supply information desired by AMM division. You will remember that AMM division has informally requested ERT to undertake a study of this type. Their request is the direct result of problems they have encountered in dispersing sterile flies in Sonora; it appears that significant numbers of native screw-worms have persisted in certain regions despite drops of sterile flies which should have overwhelmed them. Some of us believe that the eradication of screw-worm from the rest of Mexico will be comparatively easy after they have been eliminated from northwestern Mexico (Chihuahua, Sonora, and northern Sinaloa).

The proposed project is well justified technically as well as by the AMM division request. Our only problem is deciding whether or not other research should be dropped so as to shift either Mr. Hightower or Dr. Davis and supporting funds from their present assignment to the Sonora study. Of the 245,000 available for operation of the Kerrville and Mission laboratories for the last eight months of FY 57, almost one-fourth would have to be used for this one project.

We would appreciate any guidance you can give us concerning the priority this proposal should be given.

Sincerely yours,

O. H. Graham
Investigations Leader
Livestock Insects Investigations

Enclosure:
Proposal for Field Test
in Sonora, Mexico

cc:
D. G. Hightower

Proposal for Field Test in Sonora, Mexico
by
B. G. Hightower

November
~~October~~ 23, 1966

Objectives:

1. To determine the effects of high altitude releases over mountainous terrain on the dispersal patterns of released screw-worm flies.

2. To determine the effects of diurnal variations in air turbulence on the dispersal patterns of flies released from high altitudes during the early morning hours and in the afternoon.

3. To determine the release rates on population levels of sterile flies needed to suppress local populations of screw-worm flies in the mountain valleys of Sonora.

4. To determine the effects of short exposures to subfreezing temperatures during descent from high altitudes on the longevity and mating vigor of released flies.

Procedure:

It is estimated that the field studies would be conducted for 1 year. Ancillary studies would be conducted for a longer period as circumstances permitted.

A. Experimental Areas:

The localities in Sonora to be used as experimental areas will be selected by local surveys. Factors to be considered will be road-nets, terrain features, livestock populations, local climatic conditions, and the relative abundance of screw-worms as determined by previous surveys. It is proposed to conduct these surveys during January and February in order to start the tests by March 1st.

B. Methods:

1. Survey Methods.--Fly traps will be used to determine the dispersal patterns of the released flies in objectives 1 and 2. It is anticipated that 30 to 50 traps will be used in these studies. The number of traps will be limited by the abundance of other species of blowflies and limitations on personnel available for identifying the

Proposal for Field Test in Sonora, Mexico

by

B. G. Hightower

October 23, 1965

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trapped flies. Pens of wounded sheep will also be used to attract released flies. Samples of flies will be collected from the wounds as an additional estimate of the local population.

Egg masses will be collected from wounds and incubated for hatch. The proportions of sterile to fertile egg masses will be used as an estimate of the effectiveness of the calculated population level of released male flies. Approximately 50 head of sheep will be maintained in the pens. The number of pens to be used and the locations will be determined by survey.

2. Release Patterns.--Sterile flies will be released from altitudes up to 12,500 feet on single flight lanes above canyons or water courses and or on grid lanes 4 to 8 miles apart. The initial release rate will be 1,000 flies per linear mile on the single lanes or 2,000 per square mile on the grid lanes.

3. Bioclimatic Test Chambers.--The effects of short exposures to subfreezing temperatures on the longevity and mating vigor of released flies will be studied as a cooperative project with Dr. Norman Flitters, Fruit and Vegetable Insects Research Branch, Brownsville, Texas.

C. Personnel:

The following personnel will be required to conduct the field studies in Sonora.

1 Ecologist
1 Agricultural Technician
1 Livestock Inspector
4 Field Aids (Mexican Nationals)
Additional support in sorting and identifying catches of flies will be provided by personnel in the Methods Development Section, ANH.

D. Budget:

1. Salaries--The ecologist is already a staff member. An additional Agricultural Technician would be needed, but this salary could be allocated to the operating expenses of the Mission Laboratory. Actual salaries for the project would include the following:

trapped flies. Pens of wounded sheep will also be used to attract released flies. Samples of flies will be collected from the wounds as an additional estimate of the local population.

Egg masses will be collected from wounds and incubated for hatch. The proportions of sterile to fertile egg masses will be used as an estimate of the effectiveness of the calculated population level of released male flies. Approximately 50 head of sheep will be maintained in the pens. The number of pens to be used and the locations will be determined by survey.

2. Release Patterns.--Sterile flies will be released from altitudes up to 12,500 feet on single flight lines above canyons or water courses and or on grid lines 4 to 8 miles apart. The initial release rate will be 1,000 flies per linear mile on the single lines or 2,000 per square mile on the grid lines.

3. Bioclimatic Test Chambers.--The effects of short exposures to subfreezing temperatures on the longevity and mating vigor of released flies will be studied as a cooperative project with Dr. Norman Wittfers, Fruit and Vegetable Insects Research Branch, Brownsville, Texas.

C. Personnel:

The following personnel will be required to conduct the field studies in Sonora.

1 Zoologist
1 Agricultural Technician
1 Livestock Inspector
4 Field Aids (Mexican Nationals)

Additional support in sorting and identifying catches of flies will be provided by personnel in the Methods Development Section, AMD.

D. Budget:

1. Salaries--The zoologist is already a staff member. An additional Agricultural Technician would be needed, but this salary could be allocated to the operating expenses of the Mission Laboratory. Actual salaries for the project would include the following:

1 Livestock Inspector	$5,000.	
4 Field Aids	1,800. (each)	
Total		$12,200.
2. Travel and Per Diem		5,000.
3. Vehicle Operating Costs		2,500.
4. Feed and Animal Care.--$0.10 per day per animal, 50 animals for 1 year		1,825.
5. Liver bait and miscellaneous local supplies (fencing, wire, pans, posts, etc.)		500.

Total estimated budget (excluding costs of supplies already available from ANH or ENT stocks) $22,025.

1 Livestock Inspector	$5,000.
4 Field Aids	1,800. (each)
Total	$12,200.
2. Travel and Per Diem	5,000.
3. Vehicle Operating Costs	2,500.
4. Feed and Animal Care.--$0.10 per day per animal, 50 animals for 1 year	1,825.
5. Liver bait and miscellaneous local supplies (lancing, wire, pans, posts, etc.)	500.
Total estimated budget (excluding costs of supplies already available from AMH or ENT stocks)	$22,025.

Form AD-514
(Rev. 9-52)

U. S. DEPARTMENT OF AGRICULTURE

REFERENCE SLIP

DATE 11/29

REFERRED TO
Dr. Knipling

- ☐ Action.
- ☐ Approval.
- ☐ Attention.
- ☐ Comment.
- ☐ Consideration.
- ☐ Copying.
- ☐ Correction.
- ☐ Filing.
- ☐ Initials.
- ☐ Investigate and advise.
- ☐ Memorandum.
- ☐ Note and forward.
- ☐ Note and return.
- ☐ Note and file.
- ☐ Per telephone call.
- ☐ Previous correspondence.
- ☐ Recommendation.
- ☐ Record.
- ☐ Rush.
- ☐ Reply for signature of
- ☐ See me.
- ☐ Signature.
- ☐ To be rewritten.
- ☐ For your information.

REMARKS: I asked Nogh to request this program outline anticipating that Animal Health Div. will probably make a formal request that studies along the line indicated be undertaken. Sharman has already suggested this informally.

It is not clear how much financial help

(Name of sender)

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(Green)

Hugh would need.
However, I believe he would need around $10,000 additional to carry out the program.

I think it would be best to shift Davis to the proposed project. Hightower's work is more imp't & also he has responsibility for other men's work and running the station.

CMac.

11-30-66

Mr.

I think this is important and if the project materializes we should consider ways to finance the work

Ed

7